

November 5, 2016

TO: Members of the State Board of Education

Colorado Senate and House Education Committees

Colorado Joint Budget Committee Co-Chairs

Acting Education Commissioner Katy Anthes

CC: Governor John Hickenlooper, Lt. Governor Donna Lynne

FM: Tom Coyne

RE: Productively Working Together to Substantially Improve  
K-12 Outcomes and Economic Growth in Colorado

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In the nearly seven years since my family moved to Colorado from Alberta, the contrast between their respective K-12 systems and the implications of the slow pace of improvement here have become increasingly clear.

Media stories about Commissioner Crandall's resignation and the complicated dynamics on your board have finally moved me to write, to offer you a different and hopefully thought-provoking perspective on the fundamental K-12 challenges facing Colorado, and how all the parties involved can more productively work together to meet them.

As for who I am, you can read the long-version on my LinkedIn profile, so I won't bore you with it here. The short version is that I'm the son of a John Kennedy Democrat and a John Chafee Republican who is now registered as an Independent. In my youth, I worked in Washington, back in the days when people on either side of the aisle could disagree on policy, pragmatically compromise to make progress, and enjoy going out together after work. I still believe in that approach.

I've spent most of the past 35 years working around the world on difficult organizational performance improvement problems, these days with corporate boards. For more than a decade, I've invested all my volunteer time in the cause of K-12 improvement in New England, Alberta, and now Colorado, where, among other activities, I've chaired the School Accountability Committee at Wheat Ridge High School for five years, and have also served on Jeffco's District Accountability Committee.

Most recently, with some private sector colleagues I have launched a non-profit organization (K12 Accountability Inc., [www.k12accountability.org](http://www.k12accountability.org)) to systematically replicate two critical aspects of the complex, decade long process that drove Alberta's dramatic K-12 gains:

- Increasing public understanding of student achievement results and the challenges they pose; and
- Creating sustained, practical partnerships between business groups and K-12 in order to strengthen the latter's management and governance processes.

While not sufficient on their own, our experience in Alberta taught us that improvements in both these areas are necessary for the realization of substantial gains in student achievement results.

## Why Substantial Improvement in K-12 Results is Critical

Five years ago, I wrote an article in an investment journal describing a Gordian Knot of four fundamental challenges facing the world economy. Since then, the situation has arguably become even worse:

- Inadequate global demand, and therefore inadequate global income;
- Oversupply in many sectors of the economy, leading to growing deflationary pressures;
- Excessive leverage (relative to GDP growth rates), including both debt and unfunded commitments to pay future pensions;
- A growing crisis of political legitimacy, as traditional political elites have proven unable to adequately address the problems facing the global economy and alleviate the pain, uncertainty, and fear they are causing for a growing number of voters.

A sustained increase in economic growth is still the key to unwinding this knot. And in a world where rates of population increase have in many places dropped below replacement rates (particularly in developed economies), economic growth now squarely depends on increasing productivity.

In the past, productivity could be boosted by increasing investment in physical capital. In much of the world today this is no longer the case (even a substantial increase in public infrastructure, while arguably necessary, is insufficient on its own to sustain higher productivity growth).

As Eric Hanushek and Ludger Woessmann show in their book *"The Knowledge Capital of Nations: Education and the Economics of Growth"*, in today's world it is the continuous accumulation of cognitive capital that drives sustained productivity improvement and economic growth.

Yet the forces of globalization and the rapidly improving capability of multiple technologies have made it much more difficult to accumulate the new cognitive capital we need. These forces are dramatically changing the

world our children will face after K-12, and rapidly raising the bar for the knowledge and competencies they must develop while still in school.

Moreover, these changes aren't likely to slow down anytime soon. The disruption produced by the last great economic transition – from an agricultural to an industrial economy, around the turn of the twentieth century – lasted for at least forty years. Arguably, the current transition from an industrial to a digital economy only began around the turn of the 21st century, when information, communication, and technology (“ICT”) investment surpassed thirty percent of total non-residential investment in the United States, and when China's exports as a percent of its GDP began to rapidly increase.

Goldin and Katz have highlighted the implications of these trends for our schools in their book, *“The Race Between Education and Technology”* (similar points are made in *“Racing Against the Machine”* by Brynjolfsson and McAfee, and *“Beyond Automation”* by Davenport and Kirby). Students who master the skills needed to complement rapidly advancing technology will earn high compensation in the future, while those who do not will increasingly find themselves in jobs with much lower pay (e.g., see *“Poorer Than Their Parents?”* by the McKinsey Global Institute).

Unfortunately, results from a wide range of international studies, from the OECD's PISA assessments of 15 year olds' academic knowledge to its PIAAC assessments of adult skills, consistently find that too many people in the United States lack the knowledge and competencies they will need to thrive in the future.

As a recent bipartisan report from the National Conference of State Legislators bluntly noted, “We cannot ignore the reality that most state education systems are falling dangerously behind the world, leaving the United States overwhelmingly unprepared to succeed in the 21<sup>st</sup> century economy” (*“No Time to Lose”*, August 2016).

Closer to home, Hanushek and his colleagues have found that substantially improving Colorado's K-12 education results could increase the size of our state GDP by over 200% (*“It Pays to Improve School Quality”* by Hanushek, Ruhose, and Woessmann). And we all know that faster economic growth

would make it much easier to meet many of the challenges facing our state, including rising cost pressures from social safety net programs, infrastructure needs, and our substantially underfunded public sector pension plans.

It is also critical to keep in mind the likely consequences if we fail to work together to substantially improve Colorado's K-12 results and economic growth.

People of a certain age (which I assume includes most of you reading this) can still remember when California looked a lot like Colorado does today, with people and businesses attracted to the Golden State by its climate, scenery, lifestyle and growing economy.

But what do we see in 2016? Weak growth in California outside the Bay Area, rising taxes, skyrocketing spending on social safety net programs, squeezed education budgets, crumbling infrastructure, a rapidly worsening public pension crisis, more municipal bankruptcies on the horizon, and families and employers fleeing the state. Unfortunately, as residents of other states like Illinois and Connecticut can attest, these problems aren't limited to California.

As the economist Herbert Stein famously said, "if something cannot go on forever, it will stop."

A critical uncertainty is how these building state governance crises will play out in the next few years. If they are not resolved, the end game in will likely see bondholders, taxpayers, public sector employees, and the beneficiaries of government safety net programs embroiled in an increasingly bitter conflict to save their slices of a shrinking pie.

Municipal bondholders will likely be the first to lose, as they painfully learned in the San Bernardino and Detroit bankruptcies, and probably will again in Puerto Rico. In the face of sharply higher taxes, high income individuals and companies (who, thanks to worsening inequality, now account for a substantial share of most states' tax revenue) can move to less punitive states (witness the growing number of people arriving in Colorado from California and Illinois). That leaves a final showdown between public sector

employees and social safety net beneficiaries. If nothing changes, K-12 fails to improve, and economic growth doesn't revive, the end game in some states will be very ugly indeed.

Will Colorado eventually go down this path?

Some early warning signs are already apparent. Our social safety net spending is increasing as more people lack the skills to succeed in today's rapidly changing economy; we have a growing backlog of unmet infrastructure needs; our public pension funding shortfall continues to grow; a majority of voters seem frustrated with the value of services government provides and unwilling to pay more taxes for them (and because of its relative size, K-12 performance likely has a substantial impact on voters' perception of government in general); and Colorado companies are increasingly forced to import the talent needed to fill the jobs they are creating.

Can we reverse these trends in time to avoid an ugly end game here? In truth, we cannot know. The passage of critical tipping points in systems as complex the state of Colorado can only be recognized in hindsight. Given this uncertainty, the prudent choice is to aggressively pursue improvements sooner rather than later.

So let us all agree: the stakes involved in K-12 performance improvement are very high – and likely greater than many people realize.

### Colorado's K-12 Strategy

Let's start with a basic question: what is strategy? The modern term comes from the Greek word "strategia", which loosely translates as "the general's art." A strategy is a coherent set of critical choices about an organization's most important goals and how to achieve them with limited resources and an acceptable degree of risk in the face of unavoidable uncertainty.

A choice is likely to be strategic if it will have a pervasive and persistent impact on an organization.

Plans (plural) drive the implementation of strategy (singular).

A well-crafted strategy includes the following: (1) A situation assessment, including assumptions about key trends and uncertainties that could affect an organization's goals and its future ability to achieve them; (2) Decisions about the most important goals that must be achieved within a given time frame to enable an organization to survive and thrive; (3) The material and organizational resources that can be used to achieve these goals; (4) Decisions about the ways these resources will be used; and (5) An assessment of the risks inherent in the proposed strategy and how they will be managed.

Inevitably, decisions about the ways scarce resources will be used involve difficult tradeoffs; however, clarity about the evidence, assumptions and logic that underlie those tradeoffs is one of the keys to strategic success. And avoiding these difficult decisions is a path to failure.

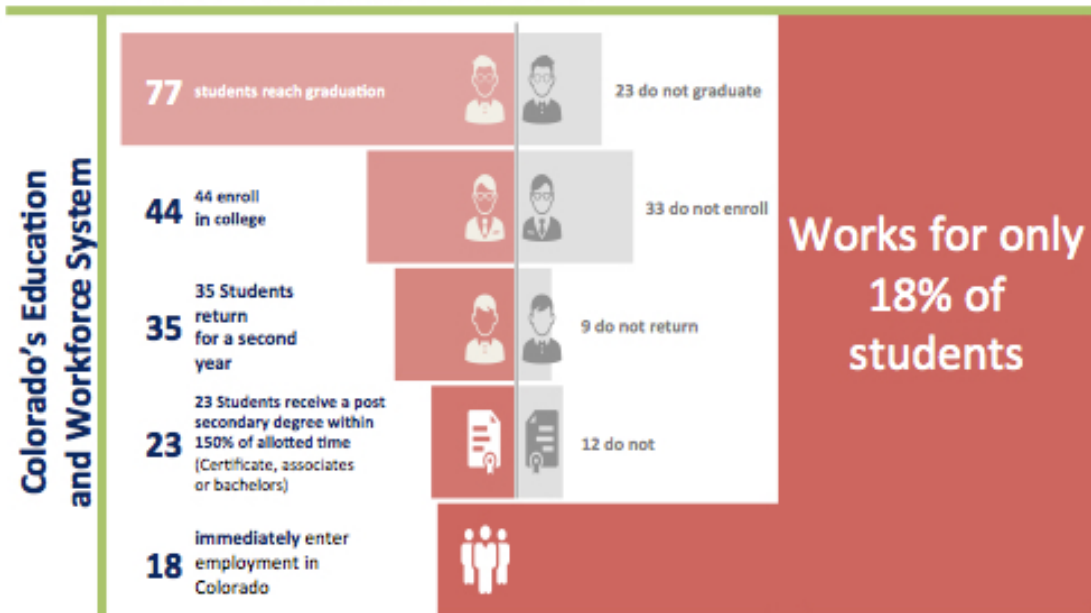
With this definition of strategy in mind, let's take a closer look at how it applies to Colorado K-12.

### Situation Assessment

While I claim no monopoly on insight, I hope that you will agree that the following are some of the critical elements in the current situation facing K-12 in Colorado:

- As multiple reports have demonstrated, Colorado K-12 currently produces poor outcomes for too many students:

## 100 9<sup>th</sup> graders begin high school



- Due to the increasingly challenging economic and social conditions we face, in order to achieve college and career readiness by the time they graduate a growing number of students need extra social and emotional supports.
- Colorado K-12 is also facing a mental health crisis. Beyond the need for more social/emotional education (or preventive measures from a health care perspective), schools are also dealing with a larger number of acute and chronic disorders than ever before. For children aged 13 – 17 (e.g., 8<sup>th</sup> through 12<sup>th</sup> grade), the Congressional Research Service has estimated a twelve-month incident rate of 8.0% for serious mental health disorders and 9.8% for moderate disorders (*“Prevalence of Mental Illness in the United States: Data Sources and Estimates”* by Bagalman and Napili, March 2015). Given the number of Colorado students in grades 8 – 12, this translates into 26,149 serious cases and 32,033 moderate cases each year.
- In so far as failure to effectively deal with these cases leads to classroom disruptions, the negative impact on achievement extends far beyond an individual student (see, *“The Long-Run Effects of Disruptive Peers”* by Carrell et al, and *“The Association Between*



*Student Reports of Classmates' Disruptive Behavior and Student Achievement"* by Blank and Shavit).

- Fortunately, we also have examples (e.g., the Wrap Around Zone and City Connects programs in Massachusetts) where well-managed K-12 collaborations with outside agencies and other organizations have delivered significant improvements (measured in effect sizes) in student mental health outcomes and academic achievement results.
- However, the achievement issues facing K-12 in Colorado go beyond poverty and the need for expanded social, emotional, and mental health supports. As the following table shows, even in our most affluent suburbs a substantial percentage of students NOT eligible for free and reduced lunch fail to meet college and career ready standards on the Grade 11 ACT:

**2015 Grade 11 ACT Percent C&C Ready**

*Students NOT Eligible for Free & Reduced Lunch*

	<b>Reading</b>	<b>Math</b>	<b>Science</b>
Lewis Palmer	69%	65%	58%
Douglas County	47%	51%	46%
Academy	56%	54%	51%
Cheyenne Mountain	63%	71%	58%
Littleton	58%	61%	55%
Boulder Valley	66%	66%	62%
Cherry Creek	52%	54%	50%
Poudre	61%	59%	56%
Jefferson County	50%	53%	48%
St. Vrain	47%	47%	46%
<i>Average</i>	<i>57%</i>	<i>58%</i>	<i>53%</i>

- A review of Unified Improvement Plans makes it clear that district and school leaders and accountability committees consistently identify non-funding related issues as root causes of Colorado’s student achievement shortfalls far more frequently than they cite budget constraints. This is not to say that additional funding will not at some point be needed to accelerate the rate of improvement in student

achievement results. In the short term, however, there appear to be many opportunities to significantly improve these results without additional funding.

- With respect to how to address the root causes identified in UIPs, we do not lack for evidence-based initiatives that have demonstrated success elsewhere in improving student achievement results. For example, organizations like the Brookings Institution and the non-partisan Washington State Institute for Public Policy (an arm of the state legislature similar to the Congressional Research Service) routinely publish meta-analyses of the effect sizes and cost-effectiveness of a wide range of K-12 performance improvement initiatives.
- That said, we also have to acknowledge that Colorado's strong commitment to local control limits our ability to adopt some initiatives that have produced significant achievement gains in other locations (e.g., Alberta's consolidation of sub-scale rural school districts; the establishment of a national or provincial curriculum that aligns with standards; or Alberta's elimination of curve-based grading to strengthen the power of teacher assigned grades as a feedback mechanism and enable a reduction in the frequency of standardized assessment).
- As part of the state Accountability law, Colorado attempted to create a systematic approach to improving student achievement results – the Unified Improvement Planning process – that was based on a technique that is widely used and highly successful in other sectors of the economy. Unfortunately, the UIP process has thus far not produced widespread and significant gains in Colorado student achievement results. This clearly suggests that one or more of the three key activities in the UIP process has been systematically deficient in districts across the state: Identification of the root causes of student achievement shortfalls, design of “major improvement initiatives” to address them, and/or the fidelity and rigor with which these initiatives have been implemented.

- There is accumulating evidence that the world is evolving towards a human capital ecosystem based on certified competencies. This development will eventually drive much tighter integration between K-12, higher ed, workplace development (which is increasingly based on competencies), and lifetime learning. After all, what are diplomas and degrees if not certified portfolios of knowledge and competencies? You can also look at what LinkedIn has been doing, as it builds an ecosystem in which members can make visible (and therefore searchable) the certified competencies they have accumulated over their careers. And LinkedIn's acquisition of Lynda will now enable them to offer just in time courses to develop new certified competencies over people's careers (obviously, this will also be disruptive to higher ed). This raises important questions about who will play what role(s) in the developing competence ecosystem. At minimum (as we have seen in the EU), these roles include competence specification, competence assessment, competence certification, and competence development.
- Colorado has a number of competence-focused experiments/pilots underway, at both the district and the state level (e.g., CareerWise).
- The capabilities of many technologies with actual or potential application to K-12 education are advancing at a rapid rate; other organizations (e.g., the military and just-in-time providers of various certified competence training offerings) are already using many of them (e.g., artificial intelligence enabled adaptive applications; virtual reality and immersive simulations, etc.).
- K-12 capture of the full benefits of these technologies will likely require, as has been the private sector's experience, substantial organizational changes. Among the factors making such changes challenging are changes in the number of people entering the teaching profession at different points (e.g., college, mid-career) and the mix of knowledge and skills they bring to our schools.
- The federal K-12 regulatory environment is, as you all well know, also going through a period of what may be significant change. This may create new constraints and new opportunities for Colorado's freedom to innovate.

- The state budget is under increasing pressure on a number of non-education fronts, including rising social safety net spending (as more people struggle in our rapidly changing economy), growing infrastructure needs, and a worsening pension underfunding situation (e.g., see, *"Feeling the Squeeze: Pension Costs Are Crowding Out Education Spending"* by Josh McGee, October 2016).
- The true size of the public sector pension deficit has been obscured by the use of a far higher discount rate to calculate the present value of future liabilities than regulations allow private sector companies to use. In a world of insufficient aggregate demand, growing deflationary pressures, and excess leverage, PERA's problems will almost certainly not be resolved by a prolonged period of high investment returns (e.g., see *"N.J. Residents Owe \$15K Per Person in Pension Debt. Compromise is the Only Fix"*, New Jersey Star Ledger, October 2, 2016; and *"The Public Pension Problem: It's Much Worse Than It Appears"*, Investor's Business Daily, July 22, 2016).
- In the absence of substantial gains in K-12 effectiveness and efficiency, there are three alternatives to solving the pension underfunding problem: (1) Substantially raise taxes to fund higher pension contributions by school districts, with either no cuts to or increased program spending; (2) Substantially cut program spending to enable higher pension contributions without any increase in taxes; and/or (3) Substantially cut pension benefits, with no changes to program spending or taxes.
- Some have claimed that issuance of a large pension bond is a magic bullet solution to this problem; unfortunately they are wrong. In essence, all a pension bond does is swap one type of liability – districts' obligation to make future pension contributions – for another – the issuing entity's obligation to service the new debt. To be sure, if PERA's earnings on the bond proceeds are higher than the interest rate on the debt (the core assumption behind every pension bond deal), the size of the unfunded liability will decrease, all else being equal (e.g., beneficiary final salaries, retirement rates, average lifetimes, etc.). But mathematically that also happens when PERA's actual

investment returns exceed its assumed 7.5% nominal annual rate. More important, it is highly doubtful that, after leveraging up their investment portfolio to effectively turn it into a multi-strategy hedge fund, plan beneficiaries would also agree to cut their benefits if future investment returns fail to cover the cost of servicing the pension bonds. A “heads we win, tails you lose” deal is not a politically viable solution to the pension problem we face.

- Some have also voiced the opinion that growing state and local public sector pension deficits will all ultimately be bailed out by the federal government. However, even if this happens it is hard to see how public pensions could remain whole when for many years private sector pension bailouts by the Pension Benefit Guarantee Corporation have involved substantial cuts in benefits.
- As a recent report from the Brookings Institution concluded, “teacher pensions aren’t great for most teachers, and the system is an underfunded disaster waiting to happen for taxpayers” (*An Underfunded Disaster Awaiting Taxpayers*”; see also, *The Revenue Demands of Public Employee Pension Promises*” by Novy-Marx and Rauh; *Scary Pension Math*” by Steve Malanga, and *Why Pensions’ Last Defense is Eroding*”, Wall Street Journal, July 25, 2016).
- Under current conditions, many taxpayers appear to have limited ability and/or willingness to pay higher taxes. In part this is due to stagnant real incomes and increased employment uncertainty, coupled with rising real costs for health care, housing, and post-secondary education. But it is also undoubtedly affected by taxpayers’ perception of the quality of services they receive from government in exchange for the taxes they pay. After all, taxes are just a price; when it comes to willingness to pay, the key issue is what you get in return, and thus the net value you receive.
- As we saw in Alberta, when voters’ perception of the quality of government services substantially improves, they can pay higher taxes and still believe they are receiving more value than before. For example, after the province’s PISA scores began to significantly improve, support for school funding sharply increased. In fact,

fnunding grew by 50% in real terms over the ten years ended in 2014, far in excess of the 11% growth in student enrollment.

- Colorado businesses today can still quite easily import out-of-state or out-of-nation talent to meet their staffing needs. However, if K-12 performance does not improve, this increasing population of imported talent will eventually grow frustrated with their children's educational results and demand substantial changes to K-12, as we have already seen in the San Francisco Bay Area.

### The System Giving Rise to The Situation We Face

Before moving on to the other elements of strategy (critical goals, choices about the way scarce resources will be used to achieve these goals, and key risks/mitigants), it is important to take a deeper look at the nature of the system that has given rise to the challenges we face today.

Technically, K-12 education is an example of a complex adaptive evolutionary system of systems (a CAESoS).

- It is complex because it is characterized by multiple cause and effect relationships, many of which are overlapping (e.g., an effect can have multiple causes, and single cause can produce multiple effects), and often characterized by non-linearity (e.g., effects not proportional to the underlying cause or causes) and time delays (effects only appear with a lag).
- It is adaptive because it is composed of intelligent agents who constantly review and adjust their behavior in light of the results it produces compared to their goals.
- It is evolutionary because the adaptive actions of agents over time often change the underlying structure of the system itself (e.g., key relationships between variables, or the potential range of values for those variables).

- It is a system-of-systems because it involves multiple interacting sub-systems at the micro, meso, and macro levels of aggregation – e.g., schools, articulation areas, districts, and the state.

CAESoS have some distinguishing characteristics:

- Their behavior emerges from the decisions of individual agents, as well as these agents' interactions within and across different levels of aggregation. In physical systems decomposition/analytical approaches that attempt to explain and predict the behavior of the whole from the behavior of the parts generally work. In socio-technical systems (i.e., CAESoS), complexity and emergence thwart this approach. At best you can develop a "coarse grained" understanding of the typical patterns of system behavior.
- This behavior is often characterized by sudden and substantial changes, which are variously described as "tipping/critical points", "regime changes", "phase transitions" or similar terms. In CAESoS, pressures gradually accumulate on various dimensions until a critical threshold is reached which triggers a major change. While not an exact analogy, the change in the state of water (from solid to liquid to gas) as temperature increases is an example of phase changes at critical points.
- This is the source of the famous "law of unintended consequences". Because cause and effect are impossible to fully decipher in CAESoS, large policy changes are practically guaranteed to produce unintended consequences. And thanks to non-linearity, these can sometimes be very large and disproportionate to the size of the underlying change.
- While reasonably accurate predication in a CAESoS is still possible over very short time horizons, it becomes exponentially more difficult as the forecast time horizon lengthens because of the emergent nature of many results of interest, and because the adaptive and evolutionary aspects of the system gradually undermine the assumptions upon which predictive models are based.

- Traditional approaches to performance improvement that are based on prediction – such as those routinely used in mechanical systems – typically fail in CAESoS, except over very short time frames. In a CAESoS, there are no silver bullet solutions. Instead, you can only experiment, learn, and adapt your way to better performance.
- Evolutionary systems use two mechanisms to ensure their survival and success over time. The first is external selection (i.e., organizations live or die), and the second is internal adaptation (i.e., the extent to which organizations or agents can change their behavior and performance in response to changes in their external environment). These are complementary; in the absence of selection threats, internal adaptation is unlikely to occur.
- In all evolutionary systems, selection is driven by some combination of organizational performance evaluation against three fundamental metrics:
  - Effectiveness: The extent to which critical goals are met.
  - Efficiency: The amount of resources required to achieve a given level of effectiveness;
  - Adaptability: The extent to which Effectiveness and Efficiency decrease as the organization or agent's external environment changes over time.
- With respect to internal adaptation, a key issue is the extent to which the internal performance metrics used by an organization are aligned with the true selection criteria in its external environment. Unfortunately, the history of organizational failure is filled with examples of mismatch in this critical area.
- Internal adaptation is also constrained by some very predictable human tendencies that, while once adaptive (in the evolutionary sense) eons ago, are decidedly less so in the modern world. For example:



- Researchers have found that our brains asymmetrically update our memories, with relatively less weight given to negative experiences, which creates a natural bias towards over-optimism.
- Researchers have found that our tendency towards overconfidence has deep evolutionary roots as a signaling mechanism in the competition to attract resources and mates.
- It is also the case that over the course of our evolutionary history it has been adaptive (at the population level) for humans to choose as group leaders people who tend to be overoptimistic and overconfident.
- In addition, all of us are also affected by confirmation bias, which is the tendency to pay more attention and give more weight to evidence that supports our existing views rather than evidence that undermines them. And as Daniel Kahneman has shown, our strong psychological need for cognitive coherence also leads us to quickly explain away anomalous data, however informative it might be.
- In a group, these individual tendencies are further reinforced by the desire to conform to the views of our peers, particularly when uncertainty is high. This produces a tendency towards groupthink, which inhibits the airing of dissenting views and the sharing of individuals' private information that does not cohere with the group's preferred story.
- When groups are aggregated into organizations, other factors can cause problems for management teams, such as our natural tendency to recruit and promote people who have similar views to our own, incentive systems that reward achieving success rather than avoiding failure, political pressures to suppress negative information, and the tendency of performance management systems to focus on increasing efficiency and predictability by avoiding errors of commission (e.g., mistakes

and false alarms), even though by definition this makes errors of omission (e.g., missed alarms and opportunities) more likely.

- Given all of these system factors, it should come as no surprise that as technology has made the world more complex (e.g., due to the explosion of new connections created by the internet), more adaptive (e.g., the exponential increase in available data, processing power, and social inputs that inform agents' decisions today), and more evolutionary (e.g., as technology makes it much easier to rapidly reconfigure systems), we have observed faster rates of change in multiple sectors that have overwhelmed the capacity of many organizations to comprehend and adequately adapt to them, resulting in higher failure rates and shorter average corporate lifetimes than ever before. Today external selection is the dominant evolutionary mechanism driving progress, not internal organizational adaptation.
- That said, there are still steps that boards and management teams can take to improve their organization's capacity to adapt and survive in today's fast changing environment:
  - Cascade critical strategic goals into a system of clear, measurable, and integrated performance targets, and regularly review and communicate (throughout the organization) progress against them.
  - Seek to keep the density of internal and external networks in rough balance. Adaptive pressures are reduced when an organization is more densely connected internally than it is externally. Similarly, adaptive pressures can be too strong (and produce internal chaos) when external connections are denser than internal ones.
  - In a System-of-System context, leaders of higher level organizations can take steps to ensure that selection processes are functioning effectively, and are based on widely understood criteria.

- Boards and management teams can also ensure that internal organizational processes, systems, structure, skills and behavioral norms support internal adaptation. For example, how strong are search processes to identify promising innovations and initiatives? How well is evidence used to select initiatives to pilot and to establish baseline expectations for the effects they should produce? Do cost management and resource allocation systems support or hinder innovation and adaptation? How effective is implementation? Is the implementation status of initiatives regularly tracked and published? Are the results of initiatives rigorously evaluated, and their effects compared to baseline expectations? Are these results and the lessons learned from different experiments/pilots regularly published and widely shared? How are false alarms and failures treated – as an opportunity to learn or a reason to punish?
- More broadly, uncertain causality, time delays and non-linear effects in an environment mean that a traditional predict-plan-do-review management approach (which assumes a deep understanding of causal processes) is unlikely to produce its intended result, particularly at higher levels of aggregation and over longer periods of time. In such an environment, a probe-wait-sense-adjust approach is often more effective.

### What Are The Most Important Goals that Colorado K-12 Must Achieve?

Given situation we face today and the nature of the system that underlies it, what are the most important strategic goals we should seek to achieve in the future?

- Colorado's fundamental challenge is a dynamic one. We are in a race against time, pitting the rate at which K-12 effectiveness and efficiency improve against the rate at which the public pension problem worsens.
- To raise Colorado's economic growth rate (and make the division of its benefits less unequal), we must substantially increase the number of

students who graduate career and college ready (based on metrics that align with the true selection criteria in the external environment).

- To enable school districts to make rising PERA payments while substantially improving student achievement results, we must use existing resources much more efficiently.
- In so far as the achievement of these goals improves voters' perception of the value they receive from K-12, it should also lead to greater willingness to invest in our public schools, triggering the virtuous circle we saw in Alberta.

### What Strategic Choices Should Guide Our Use of Scarce Resources to Achieve These Goals?

First and foremost, we need to make a collective decision about the roles of ideology and evidence in our K-12 improvement process. If our "ground rules" allow us to reject on ideological grounds even the piloting of promising initiatives, it is hard to see how we will ever substantially improve K-12 results. Instead, we will only accelerate the arrival of the end game scenario.

Years of experience around the world have taught me that no person or ideology has a monopoly on good insights and ideas. Neither does anyone have perfect foresight about the full range of potential consequences that will be produced by any performance improvement initiative.

For these reasons, the prudent approach is to agree that (1) we will prefer performance improvement initiatives that are backed by solid evidence of their efficacy elsewhere; (2) we will first pilot and rigorously evaluate them; and (3) we will only scale up those that actually produce substantial results here in Colorado.

The second major choice about how to use scarce resources to achieve our K-12 goals is a clear commitment to strengthening evolutionary processes (both internal/adaptation and external/selection) at all levels of our system

of systems, from state to district to articulation area to school. These are the fundamental drivers of improved K-12 results.

The third major choice is a sustained commitment, again at all system levels, to improved cost management and transparency. Note that this is quite distinct from K-12 accounting. Each year auditors certify the accuracy of the financial accounting and reporting in school districts' financial statements, which is essentially about whether expenses have been assigned to the right fund account and accurately summed up.

In contrast, cost management answers questions like these: What was the total cost (including both direct expenses and the value of teacher time) of professional development activities in our district last year? What metrics did we use to measure its effectiveness? What results did those costs produce? The same questions could be asked about many other critical activities undertaken by districts, such as costs related to curriculum development and various types of technology. Improved cost management almost always frees up significant amounts of money and talent that can be reinvested in higher value added activities.

The fourth choice is a much greater commitment by K-12 bodies (legislative committees, the State Board of Education, and district boards) to explicitly identify and govern strategic risks and uncertainties. I do not mean those risks that are routinely quantified, priced, and transferred at the district level (e.g., via insurance). Rather, I am talking about trends and uncertainties that could prevent the successful implementation of Colorado's strategy for substantially improving K-12 outcomes and as a result plunge the state into an ugly end game scenario.

In most organizations, management teams fail to adequately deal with strategic risks, due to a combination of normal human biases (e.g., over-optimism and overconfidence) that are often reinforced by incentives that are strongly linked to success, and further compounded by a shortage of time to spend on risk management issues. Given this, the role of governance bodies with respect to strategic risks is critical. For example, some of the questions highly effective boards always ask about a management plan include:

- Why could this plan fail?
- What early warning signs should we monitor?
- What should we be prepared to do differently if they appear?

### Implications of These Choices for Key K-12 Players

The State Board, the Legislature, and CDE all have critical roles to play in implementing these strategic choices.

Both external selection and internal adaptation are based on performance measures. One of CDE and the State Board's most important roles is to ensure that these are established, widely understood, regularly updated, and clearly communicated (e.g., via an enhanced SchoolView website and mobile app).

- Effective performance metrics are rigorous and comparable across both space (e.g., schools, districts, states, nations) and time.
- Effective performance metrics should also make it easy to relate research findings to the performance gaps we need to close, and to compare our progress to other states, provinces, and nations. Use of Effect Sizes is one approach that does this (see the attached article, *"An Evidence Based Approach to Improving College and Career Readiness in Colorado"*).
- Performance metrics need not and probably should not be the same across different levels of K-12, particularly when those levels substantially differ in their control over critical resources and decisions, and the time they have available to achieve a given performance goal. For example, district level goals should logically focus on the absolute number and percent of students across their pipeline that are meeting a set of standards, and the number and percent who graduate college and career ready (and perhaps various persistence and achievement measures beyond graduation). In contrast, individual schools control far fewer decisions and resources and have less time to affect a child's education. Logically, this leads to a preference for relative standards

like achievement growth to measure their performance (and to using rolling multi-year metrics, to reduce the noise in school growth metrics caused by changing student and teacher populations).

The State Board and CDE (and the legislature if statutory change is required) should also take steps to substantially strengthen internal adaptation processes in K-12 organizations, by building on the solid base provided by the existing Unified Improvement Planning process.

- In my interactions with CDE, I have been struck by the high quality of their staff, and how their talent is underutilized in comparison with SEAs (or their equivalent) in provinces, states, and nations that have achieved substantial K-12 performance gains (the creation of the Turnaround Network is an important exception to this). While CDE staff cannot avoid the regulatory and compliance functions that statute requires them to perform, the State Board and Legislature need to encourage CDE to add more value through expanded synthesis and analytical activities.
- For example, each year the state accountability law requires principals, superintendents, local boards, and their respective school and district accountability committees to assess their organizations, identify the most important root causes of their achievement shortfalls, implement major improvement initiatives to address them. This is an incredibly rich source of critical information that CDE should regularly synthesize and report on to the State Board and Legislature.
- We should extend to the state level the district and school level UIP approach of evaluating performance, diagnosing the root causes of achievement shortfalls, and designing major improvement initiatives to address them. Just as important, we should also add some enhancements to the UIP process:
- Major Improvement Initiatives should reflect ideas from the State Board as well as the results of an active search by CDE for initiatives from around the world that have strong evidence of effectiveness and the potential for making a substantial impact on Colorado's achievement results (as has been the case with the development of

the BASIC/CareerWise initiative). This type of systematic, evidence-based search for promising new initiatives was a key part of the decade-long “Alberta Initiative for School Improvement” that led to dramatic gains in the province’s PISA results.

- All proposed Major Improvement Initiatives should be accompanied by a summary of evidence supporting their effectiveness in previous implementations, including an estimate of the effect size we should expect here in Colorado. Taking a consistent approach to the specification of Major Improvement Initiative proposals makes it much easier to prioritize and choose between them (e.g., as WSIPP does, on the basis of their expected cost effectiveness).
- As was also the case in Alberta, CDE should simultaneously pilot the state level Major Improvement Initiatives chosen by the State Board in one or more rural, suburban, and urban districts. This parallel approach will accelerate learning about what is likely to work in Colorado. Again, the Turnaround Network and CareerWise are examples of this approach.
- The state Legislature should ensure that adequate funding is provided to CDE to support both the implementation of these pilots as well as the underlying search and evaluation processes.
- Implementation progress of these Major Improvement Initiatives should be regularly tracked and reported, and any obstacles encountered identified so that they can be overcome, or at minimum so that critical constraints on system improvement can be better understood. This critical feedback loop is currently not formally required by the current UIP process, though it is already used by the most effective SACs and DACs, and is a hallmark of high performance organizations.
- Rigorous evaluation of Major Improvement Initiative results is currently not part of the formal UIP process, which instead defaults to aggregate school or district level achievement performance. Again, this is a major oversight that should be corrected, as the effect sizes actually achieved compared to those predicted based on existing



evidence is a critical consideration in determining which initiatives to scale up beyond the pilot stage.

- Requiring a state-level application of the UIP process, and piloting as well at the district level the changes proposed above to make the UIP process more rigorous will significantly strengthen internal adaptive processes in Colorado K-12.

The State Board, Legislature, and CDE should also take steps to ensure that external selection processes are functioning well in Colorado K-12, because in their absence pressure for internal adaptation is likely to be weak, with predictable negative consequences for achievement improvement and economic growth.

- These selection processes include those that support the creation and easy student access to more education options (e.g., early college high schools, expanded dual enrollment, public school choice, option and charter schools, career pathways based on certified competences, etc.), and those that support the termination of options that have consistently failed to meet minimal effectiveness or efficiency criteria.

The State Board, Legislature, and CDE can also take action to improve cost management and transparency in K-12, to free up money and talent from existing budgets to improve results.

- For example, C.R.S. 22-44-105 specifies the budget and expenditure information that districts must present and submit to CDE. The Legislature or State Board could require CDE to work with a limited number of districts (which could volunteer, or be compelled by CDE to participate) on a pilot project to develop a standardized approach to measuring the total cost (including explicit expenditures and the value of employee time) associated with activities that are critical to student achievement, such as teacher professional development, technology development and deployment, and curriculum design (unless and until Colorado establishes a model, but not compulsory, state curriculum).

CDE should also partner more closely and substantively with the business community (e.g., via chambers of commerce and other organizations) to

speed the development of K-12's capacity to better manage the implementation and evaluation of multiple initiatives as well as to better understand and manage activity-based costs.

- Sustained and substantial K-12 collaboration with the business community was a key feature of Alberta's successful performance improvement program. Initially this took the form of business helping K-12 strengthen critical management and governance processes (i.e., capacity development). Once achievement results began to improve, business consistently supported tax increases and additional investment in K-12 to reward these gains and accelerate progress. Similarly, well-coordinated partnerships with multiple public and private organizations have been critical to the success of Massachusetts' Wrap Around Zone and City Connects programs.

Finally, the State Board and Legislature can take steps to improve the governance of strategic risks that could cause the state's K-12 performance improvement strategy to fail (and thus lead to the ugly end game we wish to avoid).

- This is certainly behavior the State Board could model, and a question that could be asked in legislative committee hearings on education policy and funding.
- The state accountability law (C.R.S. 22-11-302) could also be amended to explicitly require District Accountability Committees to provide school boards with advice on the major risks to the attainment of the district's achievement improvement goals, and steps that should be taken to address these risks.
- The standard UIP could also be expanded to require explicit identification of risks to the successful implementation of Major Improvement Initiatives, and how they will be addressed.

## Key Risks to This Strategy

An excellent way to identify the key risks to any strategy's success is to assume you are at some point in the future, and the strategy (or the organization) has failed. Ask your group to look back and explain why this happened, what warning signs were missed, and what could have been done differently. This "pre-mortem" technique never fails to stimulate an insightful and valuable discussion.

For example, the strategy I propose will fail if the size of the public pension deficit (or public perception of the degree of danger it poses) increases at a faster rate than K-12 effectiveness and efficiency improve. The former could be caused by contagion spreading from a high profile fiscal and pension crisis in another state (e.g., Illinois, Connecticut, or California), or by substantial changes in PERA's actuarial or investment variables (e.g., a sustained sharp drop in teacher resignations and/or investment returns).

Unfortunately, it is also easy to imagine why the effectiveness and efficiency of Colorado K-12 might fail to improve at a sufficient pace, above all because of two factors: (1) many organizations' and individuals' strong commitment to a current status quo that they believe serves their interests well, and (2) their belief (either explicit or implicit) that future public pension benefits are secure, regardless of the size of the funding deficit and even in the case of a very ugly end game. Of course, this belief rests on the assumption that what happened in Rhode Island – where the most heavily Democratic state in the nation voted to cut public sector pension benefits – can never happen in Colorado, and that regardless of K-12 results, voters here will always be willing to pay higher and higher taxes or accept severe K-12 program cuts in order to keep pension beneficiaries whole.

## Summary

Colorado's fundamental challenge is a dynamic one. We are in a race against time, pitting the rate at which K-12 effectiveness and efficiency improve against the rate at which the public pension problem worsens.

We face an urgent need to substantially improve K-12 performance in order to increase Colorado's rate of economic growth, which will make it much easier to meet many of the other challenges facing the state and avoid what would likely be a very ugly end game scenario.

While there is no shortage of ideas about how to improve K-12 results, their prioritization, selection, implementation, and evaluation have become trapped by a political impasse that has reinforced the unsatisfactory K-12 status quo, even as Colorado's public pension deficit continues to grow.

I have proposed a way to break this impasse and accelerate K-12 improvement by having the State Board of Education, Legislature, and CDE focus on three short-term priorities:

- (1) Strengthening core evolutionary processes in K-12 (both internal/adaptation and external/selection) to facilitate the rapid piloting, rigorous evaluation, and successful scaling up of effective achievement improvement ideas;*
- (2) Increasing the money and talent available to K-12 through better cost management and transparency; and*
- (3) Taking an explicit approach to the governance of risks that threaten the success of the K-12 improvement initiatives we pursue.*

If K-12 effectiveness and efficiency improve at a faster rate than the public pension deficit grows, Colorado can enjoy the same virtuous circle outcome we experienced in Alberta, where a pension crisis was averted due to voters' willingness to invest more taxes in a K-12 system that developed the capacity to deliver increasing value over time.

## **An Evidence Based Approach to Improve College and Career Readiness**

*(as published in YourHub/Denver Post)*

How can we move beyond the ideological differences that characterize too many discussions about education today, and get on with the critical work of substantially improving Colorado's student achievement results?

Just as evidence-based medicine has led to faster improvement in healthcare outcomes, so too can an evidence-based approach to education produce better results for our children.

Let's start with how to define the achievement improvement goals we want our school districts to meet. The last comprehensive measure we have of the cumulative result of our investment in K-12 education is the ACT assessment that is taken by every 11<sup>th</sup> grader in Colorado (which next year will be replaced by the SAT). Not only is the ACT important for college admissions, its results are also highly correlated with other tests that students may take, including the Armed Services Vocational Aptitude Battery (ASVAB), and the WorkKeys assessment for students seeking a National Career Readiness Certificate.

The ACT establishes benchmark scores for "college and career readiness" in different subject areas. Consider the 2015 results for students not eligible for the free and reduced lunch program who live in six relatively affluent suburban districts: Boulder Valley, Cherry Creek, Douglas County, Jefferson County, Littleton, and St. Vrain Valley. Only 52% of these students met the ACT's "college and career ready" standard in reading, only 54% in math, and only 50% in science.

The results for students eligible for free and reduced lunch were much worse.

Let's assume our goal is to have 75% of all 11<sup>th</sup> grade students meet or exceed the ACT's college and career ready benchmarks in reading, math,

and science. How much would a district's average score have to improve to reach that target?

If you assume that a district's ACT scores are normally distributed (i.e., they look like the familiar "bell curve" when plotted on a graph), then it is a relatively straightforward calculation.

Things get much more difficult when you ask people to divide scarce budget dollars across different initiatives to close this achievement gap. How are these decisions typically made in your district?

Too often, they seem to result from a combination of ideology and political power, with an occasional smattering of outside research evidence. Unfortunately, this approach has not produced substantial gains in student achievement performance despite the billions of taxpayer dollars we spend each year on our public schools.

Is there a better way to approach this problem? As a starting point, we need a common metric that both describes the size of the achievement gap we are trying to close, as well as the relative effectiveness of different achievement improvement initiatives we could pursue. This metric exists but it is too seldom used, much less used systematically to drive continuous improvement over multiple years.

Rather than specifying the size of the achievement gap in terms of absolute score points on the ACT or SAT, it is much more useful to use a standardized measure, in order to make it comparable not only with achievement gaps based on other tests, but also with research findings about the effectiveness of different achievement improvement initiatives.

One way to do this is to divide the size of the achievement gap expressed in score points (i.e., the average ACT score if 75% of our students met the college and career ready benchmarks, less the actual 2015 score) by the standard deviation of the 2015 scores (standard deviation is a measure of how widely those scores are distributed around their average). The resulting metric -- the size of the gap expressed as a multiple of the standard deviation -- is known as the "effect size."

The following table converts 2015 district achievement gaps in reading, math, and science in twelve Front Range districts into effect sizes:

Required Improvement in Average ACT Scores for 75%  
of Students to Meet College & Career Ready Benchmarks  
On Grade 11 ACT, Expressed in Standard Deviations  
(Based on 2015 ACT Results)

<b>District</b>	<b>Reading</b>	<b>Math</b>	<b>Science</b>
Academy	0.57	0.71	0.77
Boulder Valley	0.46	0.49	0.60
Cherry Creek	0.74	0.67	0.93
Cheyenne Mountain	0.38	0.28	0.58
Colorado Springs	1.13	1.24	1.35
Douglas County	0.71	0.73	0.82
Falcon	1.13	1.39	1.37
Jefferson County	0.80	0.88	0.97
Lewis Palmer	0.33	0.49	0.58
Littleton	0.55	0.58	0.69
Poudre	0.55	0.67	0.75
St. Vrain Valley	0.88	1.01	1.04
<i>Average</i>	0.68	0.76	0.87

<i>ACT Std Dev. (State)</i>	<i>6.40</i>	<i>5.30</i>	<i>5.50</i>
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Because district level standard deviations aren't publicly available, we've used the state level data. To convert an effect size back to ACT scale score points, multiply it times the standard deviation at the bottom of the column.

For example, the average size of the ACT reading gap equals  $.68 \times 6.40$ , or 4.35 points.

Now that we've established the size of the achievement gap we want to close (over some period of time), the next step is to look at research findings about the effect sizes for different achievement improvement initiatives that a district could pursue. Our goal is to identify a mix of achievement improvement initiatives that maximizes the expected effect size for whatever budget we have available, recognizing that the full realization of these effect size gains will take a number of years.

At this point, we confront another problem: the lack of replication of many of the findings reported by education researchers (e.g., see, "*Facts are More Important than Novelty: Replication in the Education Sciences*" by Makel and Plucker). Actually, this problem is much broader, as replicability of research findings in a growing number of disciplines is increasingly being called into question (e.g., see, "*Research Reproducibility, Replicability, Reliability*" by Ralph Cicerone, president of the United States National Academy of Sciences).

The solution to this problem is to not rely on the effect sizes reported in individual research studies, but rather on those reported from so-called "meta-analyses", which combine the results of multiple studies on the basis of the strength of the methodologies they use. Fortunately, when it comes to student achievement improvement initiatives, there is no shortage of meta-analyses we can use.

Let's start by examining the effect-sizes for four achievement improvement initiatives that are frequently encountered in district Unified Improvement Plans: Smaller Classes, Early Childhood Education, Response to Intervention (a methodology for systematically delivering more instructional support to struggling learners) and more investment in Teacher Professional Development.

The Washington State Institute for Public Policy (WSIPP) is the non-partisan arm of the Washington State Legislature that is charged with conducting meta-analyses and cost-benefit assessments of various policy proposals. Their analyses found an effect size (ES) of just .01 for reducing kindergarten



class size, and .007 for reducing first grade class size. However, these were broad conclusions; higher effect sizes were found for class size reductions targeted at younger, at-risk, and male students. Their general conclusion was as follows:

“First, the weight of the evidence indicates that, on average, class size is related to student outcomes—smaller class sizes improve outcomes, although the overall effect appears to be small. Second, the positive effect of lowering class size is much stronger in lower school grades and weaker in the upper grades. The bottom-line finding from our analysis of the evidence and economics of class size reduction is that in the earliest K–12 grades reducing class size has a high probability of producing a favorable outcome—that is, where the long-term benefits of reducing class size consistently exceed the costs. In the upper grades, on the other hand, reducing class size poses a substantial risk of an unfavorable outcome—that is, where costs may often exceed benefits” (*“K-12 Class Size Reductions and Student Outcomes”*).

It is also important to keep in mind – and this is a key point in the larger district context – that the impact of an intervention on the overall district achievement gap equals its expected effect size times the size of the treated student population relative to the overall district. For example, an effect size of .20 for a group of students who account for 30% of a district would generate a .06 reduction in the overall district achievement gap.

What about increased investment in Early Childhood Education (ECE)? In their meta-analysis (*“Early Childhood Education for Low Income Students”*), WSIPP found an effect size on achievement outcomes (in grades K – 2) of .152, that faded to .085 by grades 6 – 9. Another WSIPP meta-analysis of full day kindergarten for disadvantaged students found an initial effect size of .12, which “faded out to nearly zero by grades two through five” (*“Full Day Kindergarten: A Review of the Evidence and Benefit-Cost Analysis”*).

Response to Intervention (RTI) is, at first glance, a very common sense approach that uses assessment results to target additional instruction (“Tier 2” and “Tier 3”) at students who most need this support. Initial research on RTI pilots found very impressive effect sizes. For example, in *“Meta-Analytic Review of Responsiveness-to-Intervention Research: Examining Field-Based*

*and Research Implemented Models*", Burns et al found a median effect size of 1.09 for this approach (see also, the Institute for Educational Sciences Practice Guides for RTI in Reading and Math). Given this initial promise, over 70% of U.S. school districts now use RTI or a similar system.

Unfortunately, scaled up implementation of RTI has sometimes failed to live up to the results from the early pilots. For example, in November 2015 the U.S. Department of Education's Institute for Education Sciences published an updated meta-analysis of RTI reading interventions ("*Evaluation of Response to Intervention Practices for Elementary School Reading*") that found zero to negative effect sizes for the 20%-30% of students who received additional Tier 2 support.

What about more investment in teacher professional development (PD)? In "*Teacher Compensation and Training Policies*", WSIPP's meta-analysis found an effect size of zero for general professional development programs, and .005 for content specific PD. These findings are consistent with other studies that have found that teacher professional development investments have at best a very minimal impact on student achievement results. For example, The New Teacher Project recently found that the districts they studied spent an average of \$18,000 per year per teacher on professional development with no positive return (see their report, "[The Mirage](#)").

These PD findings are frustrating, because other research has found substantial effect sizes for the student achievement gains that result from having a highly effective teacher instead of one who is just average. In "*Measuring the Impacts of Teachers*", Chetty et al found that in New York, the effect size in elementary school was .12 for English Language Arts (ELA) and .16 for math, while in middle school it was .08 for ELA and .13 for math.

In a study of the impact of highly effective teachers in Los Angeles ("*Validating Teacher Effect Estimates Using Changes in Teacher Assignments in Los Angeles*"), Bacher-Hicks et al found effect sizes of .19 and .29 for ELA and math in elementary school, and .10 and .21 for ELA and math in middle school. Increasing the percentage of highly effective teachers in our schools is clearly an important leverage point for improving student achievement.

Unfortunately, researchers have yet to identify all the factors that drive

superior teacher effectiveness. For example, in *“Teacher Compensation and Training Policies”*, WSIPP’s meta-analyses identified the effect size impacts of the following teacher factors on student achievement results:

- Having a master’s degree =  $-.004$
- Having a graduate degree in the subject taught =  $.023$
- Individual Pay for Performance =  $.005$
- Intensive Induction Programs =  $.07$

In sum, when you compare the size of the achievement gaps districts need to close with the predicted effects of the most common initiatives they are pursuing, it is clear that they are insufficient to meet the challenge we face.

Are better approaches for closing student achievement gaps available? Let’s take a look at the effect sizes for a non-exhaustive list of other initiatives that a district could pilot.

One of the most powerful steps that a district can take is to change the curriculum it uses in a given subject. For example, the Institute of Educational Sciences’ meta-analysis of different math curricula found that switching from Investigations to Math Expressions had an effect size of  $.30$  (*“Achievement Effects of Four Early Elementary School Math Curricula”*). Similar effect sizes have been found for different reading programs (see, *“Reviewing Systematic Reviews: Meta-Analysis of What Works Clearinghouse Computer-Assisted Reading Interventions”* by Streke and Chan).

Instructional initiatives also seem to hold promise for closing achievement gaps. For example, in *“A Meta-Analysis of Interventions for Struggling Readers in Grades 4-12”*, Scammacca et al find an average effect size of  $.21$ . And in *“A Meta-Analysis of the Effects of Instructional Interventions on Students’ Mathematics Achievement”* Jacobse and Harskamp find an average effect size of  $.58$ . Finally, in *“A Nation Deceived”*, Colangelo et al’s meta-analysis found that grade acceleration of gifted students produced a  $.80$  effect size.

Another approach to student achievement improvement is broader adoption of the initiatives that have proven successful in public charter schools (via either their incorporation into district-run schools, or the expansion of

charter schools). For example, in *"No Excuses Charter Schools: A Meta-Analysis of Experimental Evidence on Student Achievement"*, Cheng et al find ELA effect sizes of .07 for ELA in elementary school, .07 in middle school, and .21 in high school. For math, the corresponding effect sizes are .12, .16, and .27.

In *"Injecting Successful Charter School Strategies Into Traditional Public Schools"*, Fryer reports that, "We implemented five strategies gleaned from practices in achievement-increasing charter schools – increased instructional time, a more rigorous approach to building human capital of teachers and administrators, high-dosage tutoring, frequent use of data to inform instruction, and a culture of high expectations – in twenty of the lowest performing schools in Houston, Texas. We show that the average impact of these changes on student achievement is 0.206 standard deviations in math and 0.043 standard deviations in reading, per year, which is comparable to reported impacts of attending high-performing charter schools."

While the research into the effectiveness of various competence-based and personalized learning approaches that make greater use of technology is still developing, there are some early indications that this area holds great promise for student achievement improvement. For example, a meta-analysis by Kurt Van Lehn found an average effect size of .79 for adaptive computer based tutoring systems (*"The Relative Effectiveness of Human Tutoring, Intelligent Tutoring Systems, and Other Tutoring Systems"*).

Increased focus on developing students' social and emotional skills is another promising student achievement improvement initiative. For example, in *"The Impact of Enhancing Students' Social and Emotional Learning: A Meta-Analysis of School-Based Universal Interventions"*, Durlak et al found an average effect size of .32 for the impact of these programs on academic performance. Similarly, in *"The Role of Noncognitive Factors in Shaping School Performance"*, Farrington et al found an average effect size of .27.

Last but not least, other research has found that improving district management and governance processes can also have a strong impact on student achievement. For example, in *"School District Leadership That*

*Works*”, Waters and Marzano’s meta-analysis found an average effect size of .24, with key underlying drivers that included:

- Establishing non-negotiable goals for achievement and instruction;
- Board alignment with and support of these goals, including allocation of sufficient resources to initiatives to meet them; and
- Regular board and district leadership monitoring of progress toward achieving the goals that had been established.

To be sure, this list of meta-analysis findings is not exhaustive, and some may argue that other studies should be included. That is a very worthwhile debate to have. It will also take time to pilot, test, and scale initiatives that are not yet being pursued by a district.

Moreover, the initiatives identified above also differ not only in their expected effect sizes, but also in their cost. As WSIPP has repeatedly noted, a critical challenge for school districts is allocating scarce K-12 funds to maximize the expected improvement in student achievement results over a given period of time.

It is also not enough to simply pilot initiatives that research suggests could have a large positive impact on student achievement performance. Districts also need to implement these experiments effectively, rigorously and transparently evaluate their results, and commit additional funds to scale up those that meet or exceed their predicted effect sizes.

In sum, it is clear that an evidence-based approach to student achievement improvement can help more of our children graduate from high school college and career ready, while also enabling the rest of us to find common ground and move beyond the increasingly polarized debates that characterize too many discussions about our public schools and our children’s future.

By taking an evidence-based approach to education, all Coloradans can win.

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