Science, Data and Decisions in New Zealand's Education System

Prepared by
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Ian Axford (New Zealand) Fellowships in Public Policy

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Educated in New Zealand and England, Sir Ian held Professorships at Cornell University and the University of California, and was Vice-Chancellor of Victoria University of Wellington for three years. For many years, Sir Ian was director of the Max Planck Institute for Aeronomy in Germany, where he was involved in the planning of several space missions, including those of the Voyager planetary explorers, the Giotto space probe and the Ulysses galaxy explorer.

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It takes a village of Kiwis to raise an Axford.

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I also thank the abstract entity known as the New Zealand Ministry of Education, my host agency for this fellowship. One of life's wonderful ironies is that constraint drives creativity, indeed constraint is a necessary though insufficient condition for true creativity to occur.[1] Through constraints both known and unexpected, our relationship drove me to take action, to improvise, to experiment and, yes, to fail – and to learn from that failure. For that I am grateful. And I'm particularly grateful to the flesh-and-blood humans that comprise 'the Ministry' and who made the effort to get to know me as both colleague and friend, including but not limited to Margaret-Anne Barnett, Howard Baldwin, Sandy Brown, Jack Georgieff, Jace Mowbray, Harry Nichol, Ed Strafford and Helen Walter. Thank you, all of you.

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I am deeply indebted to my US-based academic mentor, Dr Daniel Willingham. You will hear more from him later in this report, though unfortunately through my intermediating presence. Thank you, Dan – your contribution to my cognition continues to compound.

For those in the United States, I plan to thank you in person – and, oh, do I have stories! But I would be remiss without thanking Alice Cain Johnson and her husband Frank (you started it all, Alice!); those who wrote kind words in support of my fellowship application, including Mike Kirst, Ted Mitchell (my professional and life mentor), and Eric Westendorf; my once and perhaps future colleague (among other things), Julie Mikuta; my eleventh-hour copy editor and cite checker, Camas Goble; and, of course, my special friend Allie Kimmel, who made sure my brain was never

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[1] If you doubt this proposition, please refer to any standard airplane SkyMall catalogue and marvel in the overwhelming creative energy devoted to building products that solve problems that no one actually has (http://www.buzzfeed.com/mjs538/the-most-insane-things-for-sale-in-skymall). Creativity *without* constraint leads only to curious baubles.

lonely. Thank you, all of you, and know that you have tiny exotic presents coming your way.

To New Zealand's principals, teachers, and other educators – where do I begin? My most meaningful professional development happened through you. The time you spent with me provided me with perspective and insight that will last a lifetime. You are the strength of the system. Thank you for doing what you do.

To the students of New Zealand who found their days unexpectedly interrupted by a man with a funny accent asking seemingly random questions: I am sorry I interrupted your learning. Actually, sorry I'm not sorry – you were delightful. If I have one regret, it is that your voice is not more visible in these pages, in part because you tend to talk over one another thus making it hard to transcribe good notes. But policymakers and teachers alike would learn so much if they asked you more questions – and listened, really listened, to what you have to say. Thank you for making me wonder, for making me think, and for making me laugh.

We now reach the most terrifying part of this report, at least from my perspective. There are so many people in the broader New Zealand community to thank, the smart thing to do would be to offer a general "thank you" lest someone be forgotten. But fools rush in where angels fear to tread – a perhaps apt description for my entire fellowship experience – and so I cannot stop myself from thanking those who did so much to help me here, including but again very much not limited to Balsam Al-Dabbagh, Deidre Alderson, Clair Amos, Tim Bell, Chommanaad Boonaree, Jaimie Cable, Max Chappy, Jane Danielson, Tim Gander, Sir Peter Gluckman, Douglas Harre, John Hanna, Gary Hawke, Shaun Hendy, Paula Hogg, Anne Jackson, Associate Minister Nikki Kaye, Sharon Kelly, Tim Kong, Ivan Lomax, Jody McBrien (my fellow Axford Fellow), Sarah McKibben, Karen Melhuish-Spencer, Richard and Lyn Meylan (my downstairs neighbours), Charles Newton (President of The Counterculture), Rosemary O'Leary (my other fellow Axford Fellow), Ellen Strickland, Nat Torkington (Kiwi Foo was legend!), and Geneva Wiki. All of you, and so many others not listed here, provided an immeasurable amount of support and assistance as I carried out my research, and – in true Kiwi fashion – you did so warmly, humorously and casually. Thank you.

Finally, I want to thank three extraordinary women.

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During the fellowship selection interview in Washington DC, the Chairman of the Selection Board, former Prime Minister Rt Hon Jim Bolger asked me, "What makes you the person you are today?". The question stunned me in its simplicity and profundity. Still does.

At times this experience has been challenging, unexpectedly so. I've made the joke that New Zealand sometimes feels like a wedding where everyone knows everyone – and there is some palpable uncertainty about the strange American crashing the party. On these remote islands, there is loneliness – I have known it.

But through this fellowship, through these constraints, something changed in me here. I reached out to friends to tell them that I missed them. I turned to my family in ways that are atypical for me, drawing strength from them, showing my love in ways that have never come easy for me. They find it as surprising as I do. And they have loved me back.

Thus, thinking still of Mr Bolger's question, I will return to my country with the explicit goal of being a better son, a better brother, a better colleague, a better friend, a better *man*. This country gave me that, and in so doing, helped shape the person I hope to become.

And so New Zealand, I thank you too.

Benjamin Riley
Wellington, August 2014

EXECUTIVE SUMMARY

This report provides commentary and observation on New Zealand's education system, with a focus on the roles that scientific evidence and data play within that system.

My report begins with a summary of efforts within New Zealand to privilege the role that scientific evidence plays in determining public policy, primarily through the Office of the Chief Science Advisor to the Prime Minister of New Zealand. These prominent efforts position New Zealand as an international leader on this issue, and create the background conditions upon which the scientific mindset might flourish within New Zealand's public sector. I also include critical commentary on Sir Peter Gluckman's efforts from prominent New Zealand thought leaders. I then briefly discuss existing efforts by the New Zealand Ministry of Education to promote science in education policy and practice, including the pending hiring of a departmental science advisor and the longstanding Best Evidence Synthesis programme.

As an interlude, the report briefly examines emerging research regarding "identity-protective cognition", which suggests that individuals will be motivated to seek out evidence that affirms their standing within like-minded "affinity groups" that share certain beliefs and values. Because of this, they are motivated to reject evidence that challenges their loyalty to these groups. If this theory is correct, I argue that simply advocating for "more science" in and of itself is unlikely to lead to more (or better) science-informed decisions within the public sector. The education system in particular, I contend, at present comprises multiple affinity groups that have substantial trust issues with one another. This challenge threatens to block efforts to privilege science in education policy, on one side, *and* threatens to isolate practitioners from policymakers and prevent information interchange, on the other side.

In the next part of this report, and drawing upon my observations and conversations with educators throughout New Zealand, I examine three issues related to science, data and decisions in the education system that emerged in the course of my fellowship:

Science. I investigate whether science supports the claim that we know that learning must be "personalised", as prominent education researchers in New Zealand have argued to the Ministry of Education and the education sector. I contend that major pillars of the definition of personalised learning that these researchers endorse rest on shaky scientific foundation, and are even contradicted by our best understanding of the science of cognition.

Data. I discuss two "data puzzles" affecting in aggregate nearly all of New Zealand's public-school students. The first puzzle involves New Zealand's National Certificate of Educational Achievement (NCEA) assessment system, and in particular, the persistent gap in student performance on different types of tests as a function of socioeconomic school ranking (i.e., by school decile). The second involves educators' widespread suspicion regarding the validity of data generated by assessments related to New Zealand's National Standards.

Decisions. I describe my failure to develop a list of specific education issues faced by educators that I had hoped to compile. Instead, I relay my finding that schools rarely treat decisions as discrete events. Issues and problems are treated more as preludes to extended conversations between school leaders and teachers, with decisions "accreting" over time. Nonetheless, I suggest that oral-language acquisition and the Numeracy Project are two issues that vex numerous educators at the moment and may be worth additional investigation.

The conclusion of the report offers two specific policy recommendations designed to build trust within New Zealand's education system and expand educator access to existing scientific resources:

- **Sector Stewardships.** I propose the Ministry of Education develop a new, voluntary programme aimed at building trust between the Ministry and the education sector, one school at a time. As envisaged, Ministry employees would be randomly matched with participating schools and then sent into the field to observe them in action. After observing, listening and talking with educators in their host schools, these Sector Stewards would return to the Ministry with the goal of identifying one single issue they might *help* their host schools to think through, with the Stewards' support.

- **Digital Best Evidence Synthesis.** I propose that the Ministry elevate the prominence and support for the Best Evidence Synthesis programme by bringing the BES into the digital age (Digital BES). I suggest the Ministry hire a data-visualisation designer to develop useful and interesting tools that harness the power of the information the Ministry possesses. I propose the Ministry also hire a digital BES communications director who understands how to use social media and other technology in order to make Digital BES an ongoing conversation between the Ministry, academic researchers, principals, teachers, parents and students. And I propose that the Digital BES effort engage with social scientists to evaluate effective communication strategies scientifically.

Finally, I attempt to stitch these disparate themes together by describing the education system using a scientific metaphor.

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PREFACE

This is not the report I first intended to write.

By way of quick background, for the past four years I have served as the policy director of a US-based non-profit organisation that supports education entrepreneurship. When I first looked into applying for an Axford fellowship in late 2012, my interests gravitated toward New Zealand's efforts around "digital learning". With the investment in the Ultra-fast Broadband in Schools programme, the System Network Upgrade Project, and the newly created Network for Learning, from afar it appeared New Zealand was racing ahead in building out its digital education infrastructure. My plan was to investigate, and perhaps even help develop, policy designed to answer a seemingly simple question: having wired up the schools, what should happen next?

Upon arriving at the Ministry of Education, however, I discovered that people were struggling to figure out how to approach this question, much less answer it. In some quarters there was an assumption that digital learning would unlock tremendous benefits for learners, and therefore a corresponding belief that officials could easily produce evidence to support this assumption. But given the rapid pace of technology adoption and proliferation of various tools used in a variety of ways, the reality is that research is moving more slowly than the pace policy demands (as it so often does). New Zealand, much like the United States, is sailing into uncharted waters.

In reaction to this, I wrote a brief two-page memo that I sent to various Ministry officials sketching an "alternative vision" for education-technology policy. In this memo, which is included as Appendix 1 to this report, I argued that some of the current education initiatives tied to technology were difficult to harmonise with our best understanding of how we learn. I suggested instead placing the science of learning and thinking – cognitive science – at the centre of New Zealand's digital-learning efforts. Doing so, I claimed, might create an axis around which true innovation could occur.

The memo was fairly well received, at least insofar as various officials within the Ministry reached out to me with questions, or to say they found the vision compelling. But as I reflected further on my central thesis, I realised that my argument could (and should) apply with equal force to nearly *any* important decision within an education system. The purpose of school is to foster learning. The science of learning should therefore play a prominent role in informing all education policy and practice.

At the same time, and almost by accident, I discovered that, at the highest level, New Zealand is emerging as a key leader for 'privileging' science as an input to public policy. With Sir Peter Gluckman serving in a highly visible role as Chief Science Advisor to the Prime Minister, New Zealand is driving an international conversation about whether and how to make science more relevant and useful to policymakers and policy decisions. But I wondered, how does this top-level commitment travel through the public sector and into the education system, and even into the schools?

And so, against the advice of nearly everyone I consulted, I shifted my focus from the relatively narrow issue of digital learning to the more inchoate themes of science, data

and decisions in New Zealand's education system. More specifically: What steps are necessary to expand and privilege the role of science in education-related decisions made by principals, teachers and parents on the front lines of the education system?

How do New Zealand educators decide what to do in their classrooms? What and how much do they understand the scientific evidence to say about the process of learning – and what role, if any, do evidence and data play when they make decisions? What issues are they presently dealing with that might benefit from scientific insights? How might we encourage educators to make use of those insights? What role might the Ministry of Education play in helping to share those insights? In other words, how might New Zealand privilege science and evidence throughout the entirety of its education system?

This report comprises my investigation into these questions, and a few more I found along the way. Most of the material included in this report first appeared in draft form as posts on my New Zealand education blog **Kuranga.tumblr.com**. Indeed, although I have anonymised the names of the schools and educators I spoke to for this report, on the blog they are identified with specificity – I encourage curious readers to review my field notes there (and to enjoy the pictures).

INTRODUCTION

The dual nature of my fellowship, toggling between education policy and practice under the broad topic of science and data and decisions, is reflected in this admittedly disjointed report. The first section examines New Zealand's general efforts to promote science in public policy, and the Ministry of Education's efforts to promote science in education policy in particular. The view is from the policy side. The second section examines how New Zealand's educators are making use of science and data in their decisions. The view is from the practice side. The role of evidence and research hovers around both.

In between, there is an interlude that explores the tension in the interface between these domains. Paul Goren, a previous Axford fellow hosted by the Ministry of Education, described this tension with acute insight:

> [P]rofessionals often have divergent ideas of what initiatives might make a difference in education. Players in these different arenas use different languages and tend to talk at each other, rather than working with each other to design and execute new programmes. The result is scepticism at all levels. Policymakers believe that policies will not be well implemented. Researchers believe that important evidence will not be considered by policymakers or practitioners, and that they will not have sufficient time to generate appropriate analyses and conclusions. And practitioners believe that 'this too will pass' just like every other past policy directive.[2]

In many ways, this report suggests that scientific evidence and robust and reliable data form the common language – or at least one common language – that might be shared between education policymakers, researchers and practitioners. It assumes that if participants in the system could come together and speak in this common language, and make decisions that better incorporate our best available understanding of cognition, student learning will improve, at least incrementally and potentially quite dramatically. But if participants within the education system do not rebuild their trust in one another, this vision will not be realised. I conclude with two recommendations centred on these themes.

This report is based on extensive interviews (formal and informal), document review, and discussion with colleagues across New Zealand's education system. At the policy level, and even prior to formally beginning my fellowship, in late 2013, I arranged and attended multiple meetings in California between Associate Minister of Education Nikki Kaye and other members of New Zealand's education community with various US-based education officials and entrepreneurs. After formally commencing my fellowship in February 2014, I spent my first few months stationed at the Ministry of Education, where I participated in a variety of activities and meetings that exposed me in some degree to the inner workings of New Zealand's education-policymaking apparatus.

For multiple reasons, however, I focused on spending as much time as possible "at the chalkface" visiting New Zealand's schools. Although visiting a truly random and

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[2] Goren (2009)

statistically representative sample of this country's 2,600 public schools would be impossible given time and fiscal constraints, I deliberately designed my visits to expose me to the broad diversity of New Zealand's school system. Given my base in Wellington, over the course of my fellowship I visited six schools in the capital city or within about an hour's drive. Further, I arranged three major trips to visit schools in Auckland (six schools), in South Island from Nelson to Kaikoura (five), and around the rural east coast of North Island (five), for 22 total school visits.[3] These included visits to:

- Primary, secondary and area schools ranging from decile 1A to decile 10 and nearly every decile in between

- Urban schools, suburban schools, and rural schools ranging from as small as 18 total students to as large as 1,300

- One Kura Kaupapa Māori school

- One school providing full native-language immersion instruction for Pasifika students

- Two all-boys' and two all-girls' secondary schools

- One primary school serving 60 per cent special-needs students

- Multiple schools with modern-learning environments and an emphasis on incorporating technology into pedagogical practice, and ranging from decile 1A to decile 10

- Schools serving virtually no Pākehā students as well as schools serving virtually all Pākehā students

While there are gaps I would have eagerly filled if time permitted – Christchurch, the southern areas of South Island and the far north of North Island all stand out – on the whole these visits exposed me to a wide swath of the sector. By my estimate, over the course of my visits I spoke with and asked questions of more than 100 educators, including principals, deputy principals, assistant principals, teachers, counsellors, and students. Indeed, conversations with students often proved to be my richest source of data. Rarely afraid to speak their minds, countless students spent time answering my questions about their school and their education. Five schools arranged for structured time with focus groups of students or one-on-one interviews, which proved to be an invaluable source of insight. One school taught me their haka, and another invited me to their Matariki hāngī (the Māori New Year celebration with food cooked in an oven dug in the ground).

In addition, I attended several education-themed conferences during my fellowship, including two national conferences; three regional conferences; one rural area schools conference; one conference on education technology; and one conference for adult education. I also attended one "unconference" on science and technology, amusingly named Kiwi Foo. And I spent an unquantifiable number of hours interacting with New Zealand policymakers, educators, parents, and citizens through my blog Kuranga and other social media, primarily Twitter (@benjaminjriley).

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[3] I intend to visit 26 schools by the time I complete my fellowship so that I may misleadingly claim to have seen "one per cent" of the New Zealand school system.

1. NEW ZEALAND'S EFFORT TO PRIVILEGE SCIENCE IN EDUCATION POLICY

What is the proper role of scientific knowledge in informing public policy? And how is New Zealand promoting the use of scientific evidence in education policy? I begin by exploring these two questions in some detail.

The privilege of science in public policy in general

Setting the tone: Office of the Prime Minister's Chief Science Advisor

The notion that scientific knowledge should inform public policy, and that governments and policymakers should use scientific processes to rigorously evaluate policy effectiveness, is one of longstanding and growing international interest. Whether in Australia[4], Denmark[5], the United Kingdom[6], or the United States[7], the governments of these countries and many others are clearly interested in "evidence-based policy". It seems equally likely that many officials in these countries would agree that while the idea is obvious and appealing, "putting the principle into practice, however, is another matter".[8]

In a series of reports, papers and speeches produced in his role as Chief Science Advisor to the Prime Minister of New Zealand over the past five years, Sir Peter Gluckman offers a new and comprehensive vision for putting the principles of science into the formation and implementation of policy.[9] Discovering this body of work was one of the unexpected (and happy) surprises of my fellowship, and so this report starts with a synthesis of the key themes I see emerging from his efforts.

The most important feature of Gluckman's vision is the principle that science-derived knowledge should be treated as *privileged* input into policy formation. This privilege derives from the fact that scientific knowledge is the product of procedures designed to limit the influence of dogma, beliefs and other values. Instead of suggesting that policy should be evidence "based", which implies that evidence should sit at the foundation of policy formation, Gluckman pushes for a more nuanced perspective that recognises the reality of how policy is formed. Evidence plays an important but nonetheless *limited* role. As he notes, other factors that influence policy decisions, such as social tradition or public opinion, are important inputs that are "much more

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[4] Australian Government Productivity Commission (2009)
[5] Hansen and Rieper (2010)
[6] United Kingdom Cabinet Office: Behavioural Insights Team, Hayes and others (2012)
[7] White House Office of Management and Budget, Orszag (2009)
[8] Banks (2009)
[9] For simplicity and unless otherwise noted, this report follows Gluckman's lead in using "science," "evidence" and "research" essentially interchangeably and commonly defined as "formal processes that use standardised, systematic and internationally recognised methodologies to collect and analyse data and draw conclusions" producing "robust and verifiable knowledge, derived from [these processes]". (Gluckman Sept 2013) In addition, and unless otherwise noted, this report does *not* refer to science as the education subject-matter domain that is taught within schools and is typically comprised of biology, chemistry, physics and so forth.

value-laden – and rightly so".[10] Science can inform our decisions that relate to the pursuit of certain goals, but it cannot – and should not – define the goals for us.[11] Nor should scientists overstate what science actually knows, or is likely to discover. While this may at times frustrate policymakers and the public, Gluckman argues that science is often better suited to reducing uncertainty in complex environments, rather than providing definitive answers. Put another way, perhaps "the best that science can do is nudge and…help to channel public policy in a certain direction".[12]

Nor should the argument for privileging science mean that scientific evidence should be taken as gospel truths. Rather the opposite. In my view, science when done properly adopts a "critical attitude" toward claims about the world, understands they are always contingent, and constantly seeks "to test them; to refute them; to falsify them, if possible".[13] We must instead continually revisit what we believe to be the scientific consensus and strive to disprove what we believe we know, as the psychologist Steven Pinker argues:

> The world does not go out of its way to reveal its workings, and even if it did, our minds are prone to illusions, fallacies, and superstitions…To understand the world, we must cultivate work-arounds for our cognitive limitations, including skepticism, open debate, formal precision, and empirical tests, often requiring feats of ingenuity. Any movement that calls itself "scientific" but fails to nurture opportunities for the falsification of its own beliefs…is not a scientific movement.[14]

Or as physicist Richard Feynman once said: The first principle is that you must not fool yourself, and you are the easiest person to fool.[15]

Another theme emerging from Gluckman's writings is the need for the science community to *engage* with the policy community. In this respect, he suggests that science advisors should play a critical "science brokerage" role. "The science adviser must know how to reach out to scientists for the appropriate expertise, and help them to enact their social responsibility in making their knowledge accessible and understandable, and in being more self-aware about when they might be acting as advocates".[16]

On this particular point, Gluckman repeatedly emphasises that to the extent science is tainted by advocacy, it erodes the trust that policymakers place in evidence. As he observes, "I have heard more than one politician claim they can find a scientist to back any position on an issue – a frightening cliché in its misunderstandings of science, but one that is surprisingly broadly held".[17] In my view, this reflects the reality that policymakers hear an endless litany of claims that purport to be based on scientific findings. (So too do educators.) Lacking the time and in many cases the

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[10] Gluckman (Mar 2014)
[11] Simon (1996)
[12] Gluckman (Jan 2014)
[13] Popper (1963)
[14] Pinker (2013)
[15] Feynman (1974)
[16] Gluckman (Mar 2014)
[17] Gluckman (Jan 2014)

capability of evaluating the relative merits of competing claims, it is not irrational for the policymaker to conclude that scientific consensus is unsettled − or, just as frequently, that there is at least *enough* science to support whatever position the policymaker is predisposed to hold.

To avoid this, Gluckman suggests a set of protocols to ensure the process of obtaining science advice is relatively free of the taint of advocacy. These protocols include his recommendation that science advice be focused on gathering and interpreting data in appropriate, unbiased ways.[18] This need may be particularly acute given Gluckman's finding that "the bulk of the policy staff cadre in the New Zealand public service is still unlikely to have the research experience and/or competency to critically scan the scholarly literature and fully interpret the science".[19] Indeed, education frequently crops up in Gluckman's writings as a domain where the need for scientific input is particularly acute:

> Education policy is an area where it is easy for received wisdom to determine policy. Values are often conflated with evidence, again making obvious the need for independent scientific advice.[20]

Gluckman cites class size reduction and early-childhood education programmes as examples of complex issues that would benefit from scientific knowledge and evaluation.[21] But he acknowledges that education as a social science has a long way to go:

> It's fair to say the social departments have tended to be overwhelmed by rhetoric rather than evidence [yet] social science research is critical for governments from making good or better decisions over government expenditure. If there's one area where governments need better evidence, it's in the social domain. Education is fraught with issues and allegations that 'this is the way to do it', or 'that's the way to do it', and no one has a bloody clue.[22]

Contrary views

Not everyone in New Zealand shares Gluckman's vision for evidence-influenced policy. Emeritus Professor Gary Hawke is the former Head of the School of Government at Victoria University of Wellington and a Fellow of the Royal Society of New Zealand, Distinguished Fellow of the New Zealand Association of Economists and Fellow of the Institute of Public Administration New Zealand. He is also someone who has worked within and written extensively about the intersection of policy, innovation, and economics, and through a historical lens that to my reading reflects a deeply nuanced and insightful understanding of how policy actually gets made.[23] Hawke believes that Gluckman fails to fully grasp the complexity of policy decisions:

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[18] Gluckman (Sep 2013)
[19] Gluckman (Sep 2013)
[20] Gluckman (Sep 2013) and see personalised learning discussion in this report
[21] Gluckman (Apr 2013)
[22] Sir Peter Gluckman, personal interview, 7 July 2014
[23] Hawke (2002), Hawke (2010)

The Chief Science Advisor's papers seem to me to perpetuate a mistaken notion of a linear relationship which leads science (often divided into fundamental and applied) to innovation and thence to economic prosperity or social progress. It is a common belief among scientists (and even among academics more generally) but no serious historian of science, technology or economic development has taken it seriously for many years. Promoting innovation will not be achieved by subsidising scientific researchers.

I also regret the way the Chief Science Advisor shows no understanding at all of the policy process. His recommendations tend to be of the form, X is desirable, therefore government should generate X. There is no consideration of the difficulty of collective choice in reaching a conclusion about a desirable objective; no acknowledgment that public policy can never have a single objective – even in wartime, social cohesion was not that strong – and objectives are likely to conflict; and the process of implementation needs explicit and careful attention since efforts to generate a desired outcome may have unintended consequences. Good policy advice is more than shouting in the Prime Minister's ear.[24]

Likewise, Hawke appears suspicious of efforts to prioritise scientific evidence within public policy on the grounds that it may displace reasoned judgement:

I am sceptical of the notion of "evidence based" as I am of anything that amounts to assuming that repetition of a generally desired outcome is sufficient to guide government policy. As a slogan, it occasionally has value in drawing attention to the need to investigate the basis of an argument, but very often the assertion "there is no evidence" should be interpreted as the admission "I lack the knowledge needed to relate the available evidence to the issue under consideration".

The process of confronting logical analysis with empirical observation is much wider than what most people understand as "science". The education sector is wise to focus on enquiry-based learning rather than get hung up on "science". And the policy community is better served by organisations such as the Government Economics Network or the Association of Social Science Researchers (which seems less active than it was a few years ago) than it is by any advocacy of strengthening the science base of policy advice. We should learn together, drawing on current knowledge in all fields, not get engaged in tribal warfare among the ill-informed.[25]

In one respect, I agree with Hawke regarding the relationship between research and innovation: research validates innovation far more often than spurring it. My experience working with entrepreneurs in the US suggests that innovations typically emerge as improvised solutions to present problems under unique constraints, rather than from formal research processes.[26] And innovation in the public sector is

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[24] Emeritus Professor Hawke, private correspondence, 2 May 2014
[25] Id.
[26] As a tangential example of this in New Zealand, I found a great deal of innovation in the rebuilding city of Christchurch, where I walked through a mall comprised of shops in shipping containers, and later drank beer in a pub built inside and around an abandoned bus.

particularly challenging. As one former senior Ministry of Education official told me, "Ministers will say they want failure, but they don't really. They only want action and attribution if it works".

I also sense that "evidence-based policy" is a bit of a tainted brand, largely for the reasons Hawke articulates. Indeed, throughout my fellowship I have struggled to describe my project's focus precisely because "evidence based" and "data driven" decisions fail to capture the complexity that surrounds policymakers and educators in their respective settings. The reality is that people must decide things by making reasoned judgments in the context of particular circumstances with imperfect evidence. As commentator Leon Wieseltier observes, the danger of "over privileging" empirical evidence lurks:

> An opinion with a justification may be described as a belief. The justification that transforms an opinion into a belief may in some instances be empirical, but in many instances, in the morally and philosophically significant instances, it will not be empirical, it will be rational, achieved in the establishment of the truth of concepts or ideas by the methods of argument and the interpretation of experience.[27]

Returning to the New Zealand science-for-policy debate, I disagree with Hawke's charge that Gluckman fails to understand the complexity of the public-policy decision-making process. In my view, the opposite is true: Gluckman repeatedly points out that scientific evidence is but one of many inputs into decisions affecting public policy, and that the scientific community must understand and appreciate that policymakers will make decisions after evaluating a wide array of information. Again, privileged does not mean sacrosanct or exclusive. (For his part, Gluckman agrees, and responded to Hawke's critique by noting "this is exactly what I *don't* say…I've never said evidence makes policy. He looks at the title of my job rather than what I've done".)[28]

Meanwhile, one notable New Zealand scientist disagrees with Gluckman's normative description of science as "values-free". Dr Shaun Hendy, Professor of Physics at the University of Auckland, is the co-author of *Get off the Grass: Kickstarting New Zealand's Innovation Economy*.[29] Hendy argues that scientific knowledge is privileged not because it is values-free, but rather because it withstands scrutiny by scientists who possess a diverse range of values. In Hendy's view, "the portrayal of scientific advice as impartial and free of interests can be problematic."[30] He argues that scientists will often have to engage with communities in ways that make the values the scientist holds explicit:

> Consider the clash of interests of a government scientist, whose job it is to test water quality, and that of a community that suspects its water supply may be unsafe. The scientist may place greater weight on a test that minimises false positives, especially if they are employed to undertake many such tests. The community would likely prefer that the scientist administer a test that

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[27] Wieseltier (2014)
[28] Sir Peter Gluckman, personal interview, 7 July 2014
[29] Hendy and Callaghan (2013)
[30] Draft op-ed provided by Hendy to author, 7 July 2014

minimises false negatives, to ensure their health is not inadvertently put at risk. The scientist cannot meet the community's needs by acting merely as a knowledge broker. The scientist can succeed only through engagement with the community: by helping the community consider a range of evidence, by participating in open dialogue, and by developing an understanding of the interests of all … The voices of scientists should be privileged because they bring both the knowledge *and* the values of science to the policy arena.[31]

In this, Hendy echoes the claim of philosopher Richard Rorty that science is privileged because it encompasses "tolerance, respect for the opinions of others, a willingness to listen, [and] reliance on persuasion rather than force". These are the values that make scientific communities influential:

We should think of the institutions and practices which make up various scientific communities as providing suggestions about the way in which the rest of culture might organise itself. When we say that our legislatures are 'unrepresentative' or 'dominated by special interests', or that the art world is dominated by 'fashion', we are contrasting these areas of culture with areas which seem to be in better order. The natural sciences strike us as being such areas.[32]

Gluckman, however, believes that "the *only* thing that gives science its privilege is the processes of science. Which is about ensuring data is interpreted objectively. It's value free in its interpretation of the data. If it's not, it has no privilege".[33] On this point, Gluckman cites the work of Heather Douglas as central to his thinking about the "inferential gap", that is, the gap between "what you know and what you can conclude".[34] For this reason, Gluckman says he is in "deep in thinking and dialogue with others about this role of how science operates in the public domain. That's the hardest philosophical issue around science and the public. And the answers are not clear. It's easy to have slogans – science is values free, science is not values free – but the nuances are really very complex".[35]

The Royal Society of New Zealand, an organisation of approximately 300 distinguished New Zealand scientists, might be thought of as a mediating influence between all of these varying viewpoints. Richard Meylan, the Royal Society's senior manager for public engagement and education, suggests that Sir Peter Gluckman sits in the middle of the proverbial Venn diagram of science and policy (whereas the Royal Society is more "purist in nature", in his words). "We see our role as giving advice to government about what the science is, but not to give advice about the political process," Meylan said. "In his day-to-day activities, Sir Peter Gluckman has to go a bit further than just science. While we might report on causes of obesity, he will need to offer suggestions on what we might need to do about it".[36]

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[31] Id.
[32] Rorty (1990)
[33] Sir Peter Gluckman, personal interview, 7 July 2014
[34] Douglas (2009)
[35] Richard Meylan, personal interview, 7 July 2014
[36] Richard Meylan, personal interview, 4 July 2014

One final note in the form of mea culpa. I am acutely aware that the discussion reported here does not even come close to adequately capturing the diversity of New Zealand's scientific community. For example, this report would have benefitted immensely from the insights of Dr Michelle Emma Dickinson, Dr Sarah Morgan and Dr Siouxsie Wiles, three scientists who are driving the conversation around science communication. So too would it have benefitted from input from scientists such as Dr Michael Walker who might offer unique cultural perspectives reflecting New Zealand's Māori community. And these are simply a few names that are known to me – other communities and other voices must surely be heard. My only defence – and it is admittedly partial and inadequate – is that I focused my fellowship on schools rather than scientists, and relied largely upon random luck to connect with the scientists and policymakers quoted here. That said, I hope this report serves the *start* of a conversation with New Zealand's scientific community around science and policy, and going forward I very much hope to broaden and diversify the discussion.

Efforts to privilege science in education policy

New Zealand is unquestionably leading a growing international conversation on the role of science in policy formation. But how is that message translated and made tangible in New Zealand's public sector, and specifically within the education policymaking?

The new Chief Education Science Advisor to the Ministry of Education

In his September 2013 report to the Prime Minister on the role of evidence in policy, Gluckman recommended creating departmental science advisors (or DSAs) across the New Zealand public sector. Just as the Chief Science Advisor provides direct science advice to the Prime Minister, the DSAs would provide science advice specific to the policy domain of the departmental agency. In the wake of this, in April 2014 the Ministry of Education posted the position of Chief Education Science Advisor, to "help build capability in science-based policy advice which addresses the core educational questions of value to New Zealand".[37] The application period for this job closed in mid-May 2014 and, as of this report, active efforts are under way to fill the position.[38]

There are challenges ahead for whoever steps into this new role. One of Gluckman's key principles for providing effective science advice is that the scientific advisor report to the top: "Scientific advice must be available directly – uncensored – to the head of government or the head of the relevant department".[39] This is because "the questions for which advice is most often sought tend to be politically sensitive and cut across individual portfolios".[40] As Kristiann Allen, Gluckman's chief of staff told me,

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[37] https://jobs.minedu.govt.nz/jobtools/jncustomsearch.viewFullSingle?in_organid=17584&in_jnCounter=222490679 retrieved on 16 July 2014

[38] As this report was going to press, the Ministry of Education announced that Professor Stuart McNaughton of Auckland University will be New Zealand's first Chief Education Science Advisor. http://education.govt.nz/news/internationally-recognised-professor-takes-new-role-with-ministry-of-education/ (retrieved on 23 July 2014)

[39] Gluckman (Mar 2014)

[40] Gluckman (Mar 2014)

their "strong request was that [DSAs] would have independence in their reporting line" and "have the ear of the Minister or Chief Executive" of the relevant agency.[41]

The Ministry of Education is not following this recommendation. Instead, the newly hired departmental science advisor will report to the deputy secretary of the Evidence, Data & Knowledge unit within the Ministry. In my view, this may pose a serious challenge for the incoming Chief Education Science Advisor in spreading the influence of scientific evidence on policy development. During my time working within the Ministry, I found a surprising lack of communication across the various subgroups and units, perhaps driven in part by the actual physical separation of the Ministry throughout multiple buildings. Indeed, when I asked Ministry employees to describe the organisation in a few words, the words "hierarchical" and "siloed" were frequently invoked. The Chief Education Science Advisor will need to find ways to cut through these silos and act as an "honest broker" within the Ministry's somewhat opaque policymaking apparatus. I suspect that having a direct line to the Ministry's chief executive would help in this tremendously.[42]

After reviewing a draft of this report, the Ministry offered a contrasting view:

> While the Chief Education Science Advisor [CESA] will report to the Deputy Secretary, the person will have a direct link to the Chief Executive and our Ministers. The CESA will play an important part in cross-sector communications and dialogue and shared understanding of the evidence within the education research community. However, there is a wider role to link data and evidence to policy and practice. This wider role includes how the Evidence, Data and Knowledge [EDK] Group promotes such connections. Having a reporting line from the CESA to the Deputy Secretary EDK makes sense in this context.[43]

My concern here is perception. While I am confident that new Chief Education Science Advisor will be able to liaise with the Chief Executive and the relevant Ministers on occasion, by placing the CESA in a reporting position within one subgroup inside the Ministry, I suspect the CESA will be viewed as part of that particular team, and not someone with a portfolio spanning across the entire Ministry. Also, I have worked in politics long enough to know that *perceived access* to policy decision-makers is very powerful currency when pushing an agenda. Rightly or wrongly, having a direct *line* is viewed very differently from having a direct *link*. But nothing would delight me more than if the Ministry and the incoming Chief Education Science Advisor falsify my hypothesis.

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[41] Kristiann Allen, personal interview, 7 May 2014

[42] When I asked Sir Peter Gluckman if he was concerned with the Ministry's structuring of the Chief Education Science Advisor role, he said he was "reasonably relaxed" about it. "It's a small country. Where [the] person reports won't be [the] thing that makes or breaks [the] job, it'll be [the]quality of person appointed to [the] job. This is evolving, we are not getting there overnight. If I don't go gently on this, people will be outraged – there was much lobbying against [my] role being created in the first place". (Personal interview, 7 July 2014)

[43] Ministry official response, 18 July 2014

The Ministry of Education's Best Evidence Synthesis programme

For more than a decade, New Zealand has made a serious and dedicated effort to promote and privilege the use of scientific evidence in education-related decisions. The iterative Best Evidence Synthesis programme (or BES) is designed to foster the use of rigorous evidence-based research within and across New Zealand's education system and "systematically identify, evaluate, analyse, synthesise, and make accessible, relevant evidence linked to a range of learning outcomes". To that end, BES employs a "'jigsaw methodology" that "brings together pieces of the puzzle about influences on learner outcomes that are often spread over and embedded within a range of research studies". BES places particular emphasis on "longitudinal findings indicating that achievements and social outcomes are sustained rather than transitory".[44] Similarly, BES privileges scientific theory "as a tool for change because it explains the why and the how of what works in ways that can support the development of expertise".[45]

The BES programme produces a variety of written material for educators to review and use to inform their practice. The major BES reports, which typically run between 75 to 125 pages, include topics such as Effective Pedagogy in the Social Sciences – Tikanga ā iwi; Professional Development in Early Childhood Settings; and School Leadership and Student Outcomes – He Kura Rangatira.[46] The BES programme also produces shorter pamphlet-size summaries of these syntheses. In addition, complementing the major reports are shorter exemplars, typically around 20 pages, that focus on the application of research within a real-world New Zealand school context. Topics covered by the exemplars include Developing Communities of Mathematical Inquiry, Ripiene Āwhina ki te Pānui Pukapuka (RĀPP) (Accelerate reading and comprehension achievement in te reo Māori), and Teacher and Student Use of Learning Goals.[47] Finally, BES has produced 32 separate case studies that typically run five to ten pages and cover four major domains: (1) School leadership and student outcomes; (2) Effective pedagogy in mathematics; (3) Effective pedagogy in social science; and (4) Teacher professional learning and development.[48]

Fully describing and analysing the BES programme could be the subject of an entire separate Axford report, so I will summarise my perspective in three words: BES is comprehensive, complex and compelling. What I find uniquely impressive about BES is the focus on research proven to raise student-learning outcomes (rather than theory devoid of empirical support). At the same time, BES recognises that "just because an approach is research-based does not mean it is trustworthy from an investment perspective" (citing the now widely discredited yet still commonly held theory of student "learning styles").[49] And, perhaps most importantly, the BES syntheses, exemplars and case studies probe deeply into *relevant* research. It does not surprise me that New Zealand educators and other international observers have developed a deep appreciation for the BES:

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[44] Alton-Lee (2004)
[45] Alton-Lee (2012)
[46] BES, http://www.educationcounts.govt.nz/publications/series/2515 retrieved on 16 July 2014
[47] BES, http://www.educationcounts.govt.nz/topics/bes/bes-exemplars retrieved on 16 July 2014
[48] BES, http://www.educationcounts.govt.nz/topics/BES/bess-and-cases/bes-cases-overview-and-list retrieved on 16 July 2014
[49] Alton-Lee (2012)

> What is distinctive about the New Zealand [BES] approach is its willingness to consider all forms of research evidence regardless of methodological paradigms and ideological rectitude, and its concern in finding...effective, appropriate and locally powerful examples of "what works".[50]

What's not clear is whether the BES vision and methodological approach enjoy the same support within the Ministry of Education. For example, when I remarked to one senior Ministry official that I found the BES exemplar on developing communities of mathematical inquiry particularly compelling[51], the official dismissed the findings as "not generalisable". This critique strikes me as misguided. The exemplar illustrates the *application* of a particular approach to education that is supported by research – here, developing classrooms where students engage with the teacher and each other in mathematical inquiry, reasoning, and argumentation.[52] As such, the BES exemplars and indeed all the BES materials report observations and data as potentially useful guides for educators to follow and adapt to the context of their unique school environments. Not everything that is scientific or useful is the product of generalisable findings from randomised control trials.

Dr Adrienne Alton-Lee oversees the BES programme and is responsible both for its creation and shepherding since its inception. After reviewing a draft of this report, she offered comments that appear to confirm my suspicions regarding the Ministry's support at present for the BES programmatic work:

> The capability building is missing.[53] *There is now a fundamental question about the viability of the programme*, its future direction and its place in the Ministry of Education. The pressures and inherent tensions in doing this work with only 1.6 full-time employees and contracted support have become impossible.[54]

After reviewing a draft of this report, the Ministry of Education separately offered an "official response" that included the following statement on the BES programme:

> The BES does enjoy broad support within the Ministry. In particular almost every significant piece of work from the Student Achievement Group has been informed, if not driven, by the principles underpinning the BES.[55]

As I recommend later, I believe the BES programme deserves renewed support from the Ministry and refreshed attention from the sector. Evidence is a roadmap – but only a map. Ultimately, the journey must be travelled by schools, teachers and students in

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[50] Luke and Hogan (2006)

[51] Attached as Appendix 2 is a one-page summary of this exemplar that I created as a potential prototype for new communication strategies related to BES, as I recommend in this report's conclusion.

[52] http://www.educationcounts.govt.nz/publications/series/2515/developing-communities-of-mathematical-inquiry/introduction-to-case-1 retrieved on 16 July 2014

[53] Alton-Lee believes the biggest policy loss resulting from the loss of this capability is the failure to appreciate "the key BES finding about the significance of effective professional development underpinned by high impact R&D and the prevalence of ineffective or even harmful [professional development]". Timperley, H., & Alton-Lee, A. (2008)

[54] Dr Alton-Lee, e-mail correspondence, 18 July 2014 (emphasis added)

[55] Ministry official response, 18 July 2014

the context of their local communities, and the same destination will rarely be reached.

2   INTERLUDE AT THE INTERFACE

Identity-protective cognition and the challenge of rebuilding trust

In the first section of this report, I explore the ways in which New Zealand is promoting a privileged role for science in public policy in general, and in education policy specifically. In the section that follows this interlude, I explore the myriad ways in which science, evidence and data inform education issues and influence decisions in practice. Section one peers out from policy, section two stares back from practice.

Here in the middle, I want to explore the *interface* between policy and practice and two major challenges to the basic argument advanced in this report, namely, that we should strive to make education systems more scientific. The first challenge involves the threat of identity-protective cognition; the second challenge involves trust. They are closely related.

If one accepts the premise that science should be a privileged input into public policy, and if one believes that issues of public policy are not as well informed by scientific evidence as they might be, a logical conclusion is that we simply need "more science". Or, more accurately, what's needed is a concentrated and sustained effort to improve science comprehension and raise scientific critical thinking skills across the public sector and even the public generally. If we improve science comprehension, we might assume, decisions will improve.[56] Sir Peter Gluckman echoes this argument in his push for "a public service culture that has the attitudes, capabilities and internal processes to support the generation and use of quality evidence derived through formal processes". To build that culture, Gluckman argues, there must be "concerted efforts to lift capabilities within public service communities of practice so that there is capacity to evaluate such evidence without bias and with rigour".[57]

The problem with this perfectly reasonable argument is that emerging research suggests it may not be true. In a series of studies, Dan Kahan of Yale University has produced mounting evidence that suggests, counterintuitively, that increasing science comprehension and science fluency may actually *increase* political polarisation, and *decrease* the capacity of individuals to evaluate evidence in neutral, disinterested fashion.[58]

The paradoxical problem is identity-protective cognition. Under this theory, individuals are seen as members of like-minded 'affinity groups' composed of others who share similar values and beliefs. This may include political party membership, religious affiliation, professional work-related affinity groups (such as unions), or any number of other methods of association. Membership in an affinity group, Kahan argues, plays a pivotal role in defining an individual's self-identity and how they come to interpret evidence and information:

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[56] Sunstein (2007)
[57] Gluckman (Sep 2013)
[58] See Kahan and others (Sep 2013), Kahan (Feb 2013), Kahan and others (2011), Kahan and others (2010), Kahan and others (2007)

> Individuals … have a large stake – physically as well as materially – in maintaining the status of, and their personal standing in, affinity groups whose members are bound [in] their commitment to shared moral understandings. If opposing positions on a policy-relevant fact – e.g., whether human activity is generating dangerous global warming – come to be seen as symbols of membership in and loyalty to competing groups of this kind-, individuals can be expected to display a strong tendency to conform their understanding of whatever evidence they encounter to the position that prevails in their [group]. A form of motivated reasoning, identity-protective cognition can be viewed as a psychic self-defense mechanism that steers individuals away from beliefs that could alienate them from others on whose support they depend in myriad domains of everyday life.[59]

Kahan's research suggests that the reason that certain issues remain hotly disputed despite relevant scientific evidence is not that individuals fail to comprehend the science; instead, they use their scientific reasoning skills to *reject* science that threatens their membership in their affinity groups. Scientific comprehension and critical thinking thus become weapons to be deployed in political debate, rather than cooling mechanisms leading to neutral and dispassionate evaluation of the evidence.

Of what relevance is this to education policy and practice? In the US, my experience overwhelmingly accords with the basic tenets of the identity-protective cognition thesis. As a slight digression, perhaps no example more vividly illustrates this than the current effort by approximately 45 states to adopt common academic standards in reading and math known as the Common Core State Standards. Most states adopted the Common Core standards four years ago with relatively little fanfare, with comprehensive input from researchers and with broad political support from groups ranging from the (left-leaning) major teachers' unions to the (right-leaning) US Chamber of Commerce and Jeb Bush, former Governor of Florida and likely 2016 presidential candidate for the Republican Party.

Relatively recent agitating by members of the far-right "Tea Party" movement within the Republican Party, however, is making opposition to the Common Core all but a requirement to prove one's conservative bona fides. To a somewhat lesser extent, the same danger lurks on the left, where growing opposition to "high-stakes testing" that is tied to the Common Core is causing further polarisation. Already a handful of states have abandoned or weakened their support for the Common Core and the corresponding assessments, and the issue looms large for the 2016 Presidential race. In other words, this major education policy is in danger of becoming politically toxic because the debate is now about self-identities, and will likely foreclose reasonable discussion of the evidence.

Here in New Zealand, the relevant question is whether similar forms of identity-protective cognition threaten issues of public policy, and in particular, issues involving the evidence that relates to education policy and practice. This brings me to the second challenge, around trust.

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[59] Kahan and others (Sep 2013)

Research confirms what intuition suggests: Trust is a necessary precondition to improving education-related decisions. "Collective decision making with broad teacher buy-in, a crucial ingredient for reform, occurs more readily in schools with strong relational trust".[60] My most obvious but alarming observation, after spending six months immersed in multiple levels of the New Zealand education system, is that there is an overwhelming need to rebuild trust. There are trust issues between the Beehive and the Ministry. There are trust issues within the various subgroups within the Ministry. There are trust issues between the Ministry and the sector. There are trust issues *within* the sectors. There are trust issues across and within different demographic groups. And no one trusts the press.

Why is trust so lacking? I do not know. What's more, I deliberately *avoided* trying to uncover the answer. As an outsider with no particular political agenda in this country, I hoped to position myself as a 'critical friend' to *all* participants within the education system, and perhaps serve as a mediating conduit of communication between them. Understanding whether one side or another had greater cause for complaint thus threatened to interfere with my goal of developing collective empathy.

The trust issue blinking brightest red is that between 'the Ministry' and 'the Sector'.[61] Both Ministry officials and educators are well aware of this tension so I will not belabour it here, save for one observation. Early in my Fellowship, I noticed that Ministry officials and New Zealand educators both invoke these binary and abstract terms to describe the education system as a whole. While I understand the need for shorthand descriptions to describe subgroups within a complex system (I use both terms in this report), I wonder if they serve to compound the mental and physical separation between the public officials tasked with developing New Zealand's education policies, and those who serve at the frontlines implementing those same policies. Is 'the Ministry' one affinity group, and 'the Sector' another? And if so, what does that suggest about the identity-protection cognition that both sides employ?

Trust issues extend vertically as well as horizontally. Perhaps no moment was more telling to me than when, during a small group discussion of my work with a group of junior policy analysts at the Ministry, one analyst said she was envious I was spending so much time visiting schools. When I suggested she reach out to schools and schedule visits herself, she laughed and predicted it would be "many years" before she would be allowed to step inside schools unsupervised as a Ministry employee, "because they don't trust what would happen or what I would say if I did that now". Almost every head at the table nodded in agreement. I recognise there must be parameters around the interactions between Ministry employees and schools for various reasons, but if young policy analysts feel as if they are prohibited from directly engaging with the schools they serve, something is wrong.

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[60] Bryk and Schneider (2003)

[61] As Dr Alton-Lee observed after reviewing a draft of this report, "the critical role of relational trust in educational improvement" is highlighted in the BES programme synthesis on school leadership. (http://www.educationcounts.govt.nz/publications/series/2515/60169/60170) Moreover, "a recurrent finding reported, that should give pause for thought, was the drop in achievements associated with policy workers engaging with schools. There are good examples of the ways in which relational trust…can be forged by policy organisations. Further deliberative inquiry around this issue could be valuable for the Ministry". Email correspondence, 18 July 2014

The good news is that the present chief executive of the Ministry of Education is currently reorienting the Ministry around the notion that the Ministry and its employees should serve as 'sector stewards' rather than as 'sector leaders'. My time in the field suggests this shift is being *very* well received by those who are aware that it is taking place. If this philosophical shift takes root within the Ministry, I believe it will do wonders for rebuilding trust. Indeed, my first recommendation is designed to spread the message of Ministry stewardship broadly throughout the sector, and with pace.

Trust issues exists within New Zealand's school sector as well. For such a relatively small education system, it is remarkably fragmented. (As one former Ministry official memorably put it, "the problems of education systems are fractal".) This manifested itself most obviously to me in the division between primary and secondary schools, which at times seem to function as wholly separate systems. I think of the talented veteran primary school principal who cheerfully admitted she "hadn't a clue" how the NCEA system works. And there are trust issues within school groups as well. One deputy principal told me she planned to join a cluster of schools led by one with strong mathematics student-outcomes data – not because she wanted to learn from this school, but to instead confirm her suspicion that it was, in fact, fudging its results.

Unless and until all participants with New Zealand's education system genuinely believe they are part of a joint enterprise in the service of this country's students, identity-protective cognition and issues of trust will derail any attempts at true collaboration that makes use of the best available evidence. Instead, questions of policies and practice will continue to revolve around deciding "whose side are you on?" rather than "what do we know about this issue, and how might we work together on it?".[62]

In my opinion, rebuilding trust should be New Zealand's highest education-policy priority.

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[62] I note in passing that New Zealand's new Investing in Education Success policy, which would invest $359 million in building voluntary career ladders for principals and teachers and raising their salaries accordingly, is currently *opposed* by New Zealand's primary school teachers' union. When this issue came up in conversation with primary school educators, some ignored the policy in order to focus on attacking its source (that is, the current government). To be candid, they appeared far more interested in 'picking sides' rather than helping develop what in my view *could* be a very innovative and supportive new policy that they themselves stand to benefit from immensely.

3   SCIENCE, DATA AND DECISIONS IN EDUCATION PRACTICE

If the first section addresses science as privilege to policy in an abstract sense, this second section examines evidence and data in a slightly more practical sense. More specifically, in this section I explore *what* educators are being told about the science of cognition; *why* there are reasons to wonder about the validity of two major sources of student-achievement data; and *how* educators actually make decisions (or not).

The science, or lack thereof, in support of personalised learning

One of the central assumptions of this report is that decision-makers within New Zealand's education system – or any education system, for that matter – should incorporate the insights of science into their decisions, and in particular cognitive science. If one purpose of education is to impart knowledge and improve learning, making use of the best available scientific evidence on how we acquire knowledge, on how we learn, seems helpful in making progress towards this goal. Policies and practices that align with our best understanding of cognition should lead to improved student learning outcomes on just about any measure.

It is beyond the scope of this report to fully explore the science of cognition. But in his book *Why Don't Students Like School?*, Dan Willingham, a cognitive scientist at the University of Virginia, sets forth nine key principles that represent the scientific consensus around what we know about learning[63]:

1. People are naturally curious, but we are not naturally good thinkers; unless the cognitive conditions are right, we will avoid thinking.

2. Factual knowledge must precede skill.

3. Memory is the residue of thought.

4. We understand things in the context of what we already know, and most of what we know is concrete.

5. It is virtually impossible to become proficient at a mental task without extended practice.

6. Cognition early in training is different from cognition late in training.

7. Children are more alike than different in terms of how they think and learn.

8. Children do differ in intelligence, but intelligence can be changed through sustained hard work.

9. Teaching, like any complex cognitive skill, must be practised to be improved.

New Zealand's policymakers and educators are receiving different and in many ways contradictory advice on what we purportedly know about learning. In 2012, the New Zealand Council for Educational Research (NZCER) prepared a report titled *Supporting Future-oriented Learning & Teaching – a New Zealand Perspective*. Among other things, the report purports to identify 11 key principles emerging from

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[63] Willingham (2009). Willingham also served as my US-based academic mentor for this Fellowship.

the "vast body of research on learning". The title of the table 3 that lists these principles makes clear that, at least in NZCER's view, the 11 principles comprise "what we know about learning".[64] In other words, these are claims about cognition.

A few of the key principles articulated in the NZCER report as what we know about learning accurately reflect the current scientific consensus. For example, the NZCER report correctly states that "learners need to develop in-depth knowledge in some areas if they are to go on learning".[65] But many of the principles in the report conflate claims about what we know about learning (cognition science) with arguments about what *values our education system ought to embrace*. Perhaps the most egregious example is the following claim regarding personalised learning:

> Learning has to be a *personalised* – not a standardised – experience. Learners have to feel in charge of their own learning. They need to feel that they know what they are doing, and that they can control the pace of their learning. They need to "get into it" enough to get a sense of flow and progress; they need the right amount of challenge (not so much that it is beyond them, but not so little that it is boring); and they need feedback along the way (not just at the end of the course). Young children need help to do this, but to learn more (and become better learners), they need to be able to regulate their own learning and become less and less reliant on the teacher to regulate the pace and goals of learning.[66]

The problem with this alleged principle is that most of its components do not square with our current understanding of cognition. People learn by thinking, but "feeling in charge" is not an absolute precondition to thought. Direct Instruction (DI), for example, uses specific curriculum and endorses a pedagogical approach that is explicitly teacher centric and *minimises* student agency. John Hattie's meta-analysis of 304 studies covering 42,000 children receiving DI returned an effect size of 0.82, more than any other curriculum and second only to feedback in overall effectiveness.[67] Other research suggests that minimally guided instruction, which appears to philosophically undergird the claims about student "feeling in charge" of their learning, is equally suspect: "The past half-century of empirical research on [minimally guided instruction] has produced overwhelming and unambiguous evidence that [it] is significantly less effective than guidance specifically designed to support the cognitive processes necessary for learning".[68] Indeed, "controlled

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[64] Bolstad and others (2013). Indeed, the Honourable Hekia Parata, New Zealand's current Minister of Education, states in the foreword to the NZCER report that "this synthesis of findings from existing work and new research presents emergent principles that signal shifts in how we need to think about learners and learning".

[65] Curiously, the NZCER report does not itemise citations in support of its key principles but instead generally cites Bransford and others (2000), Hattie (2009), Perkins (2009), Zull (2011) and, interestingly, Willingham (2009). There also appears to be some general reliance on non-scientific sources such as Christensen and others (2008) and Fullan (2010).

[66] The section of the NZCER report that discusses personalised learning in more detail appears to rely heavily on the work of Charles Leadbetter. (See Bolstad and others (2013) at pp. 17-24.) While Leadbetter's ideas are certainly thought-provoking and interesting – I consider him a friend – he is not a scientist and would almost certainly disavow any notion that his claims are grounded in existing empirical evidence.

[67] Hattie (2009)

[68] Kirschner and others (2006)

experiments almost uniformly indicate that that when dealing with novel information, learners should be explicitly shown what to do and how to do it".[69] This same evidence also contradicts NZCER's claim that young learners "need" to become less reliant on teachers.

Nor do students "need" to feel they can control the *pace* of their learning. Given that our brains are designed not for thought but the avoidance of thought (Willingham's first principle), ceding control of the pace of learning invites learners to avoid new and unfamiliar tasks.[70] This will slow the velocity of their learning and potentially lead to large knowledge deficits, which will cause these learners to slow down further, until eventually they "switch off" from school. One way to prevent this slow downward spiral for these students is to push them harder and faster. *But they probably need to be pushed*, which means we should approach claims about learners self-regulating the pace of their learning with extreme caution.

What we *do* know is that knowledge is cumulative.[71] What a child is capable of learning depends upon what she already knows. When a child encounters new information, if she lacks the pre-existing knowledge to put the information in context, she will quickly become frustrated. She will not learn. So to the extent personalisation seeks to devolve a greater degree of the responsibility of acquiring new knowledge to students, it relies on the mistaken assumption that many or most students are properly equipped to make sense of new information:

> There is a large body of research which shows that not all learners prefer nor profit from controlling the tasks and that forcing such control on them can be counterproductive…The reason for this is that learners do not have or do not know how to utilize appropriate strategies when they are left to themselves to manage their learning environment (i.e., they do not have the capacity to appraise both the demands of the task and their own learning needs in relation to that task in order to select appropriate instruction). In other words, learners often misregulate their learning, exerting control in a misguided or counterproductive fashion and not achieving the desired result.[72]

Moreover, while maintaining the appropriate level of challenge and providing feedback are indeed critical to learning, it is an open question whether educators should be orienting pedagogical practices around student differences so as to 'personalise' the experience, or whether it would be better to instead take note of the many ways in which students are cognitively similar, and make these *shared* characteristics the focus of our education efforts. The former is not without its romantic appeal, but the latter finds greater support from cognitive science:

> There is no doubt that students have individual differences that are both situational and preferential. And there is no doubt that effective teachers address these differences using their own experience as a guide. But when it comes to applying research to the classroom, it seems inadvisable to categorize students into more and more specialized groups on the basis of peripheral

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[69] Kirschner and others (2006)
[70] Kicken and others (2009)
[71] Willingham (2006)
[72] Kirschner and van Merrienboer (2013)

differences when education and cognitive sciences have made significant progress in describing the core competencies all students share. *Teachers can make great strides in improving student achievement by leveraging this body of research and teaching to commonalities, not differences.*[73]

Of course, there may be other benefits to personalisation that have nothing to do with improving cognition, such as making resources more flexible, attracting new talent into the profession by creating more dynamic workplaces, spurring development of new and effective technologies, or other non-cognitive benefits. But these reasons are not *grounded in what we know about the science of learning*, and its supporters should not claim otherwise. We must "move education efforts from the fuzzy and unproductive world of ideology…to the sharp and productive world of theory-based research on how people learn".[74]

Luckily, there are voices within New Zealand education-research community that recognise the need to move away from fuzzy theories. After reviewing a draft of this report, Dr Alton-Lee of the Ministry of Education said:

> Issues around the origins, evidence-base, and unintended consequences of personalised learning as a policy driver have deep significance. If we keep orienting teachers to this discourse, we risk the pedagogy focusing on 1:1 interactions between the teacher and a student, with opportunity costs for the other students in the same class that mount over time. The inevitable call from the profession will be for small class sizes if we are not growing capacity for powerful cooperative learning approaches that accelerate achievement, counter bullying and intensify supports to learners at every stage of the day.[75]

This statement of Alton-Lee is exactly on point, at least in my opinion. Yet, oddly, in its official response to this report the Ministry of Education contends "the history of [New Zealand] usage of personalised learning comes in part from the BES…particularly the foundational BES on teaching diverse learners". The Ministry also offers its own definition of personalisation: "The concept refers to teaching which is optimally matched with current levels of knowledge and skill, and the familiar contexts for those".[76]

The Ministry's official response underscores why arguing against personalised learning sometimes feels like a game of education whac-a-mole.[77] Not only is the Ministry's definition very different from that offered in the NZCER report, the BES programme on teaching diverse learning has almost nothing to do with personalisation as anyone defines that term. If anything, the Ministry definition appears consistent with *differentiated* instruction, but differentiated does not mean personalised.

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[73] Willingham and Daniel (Feb 2012) (emphasis added)
[74] Mayer (2004)
[75] Dr Alton-Lee, e-mail dated 18 July 2014
[76] Ministry official response, 18 July 2014
[77] In case this game is unfamiliar to the New Zealand audience, I paraphrase from Wikipedia: A typical Whac-A-Mole machine consists of a large cabinet with holes in its top and a large mallet. Each hole contains a single plastic mole and the machinery necessary to move it up and down. Once the game starts, the moles will begin to pop up from their holes at random. The object of the game is to force the individual moles back into their holes by hitting them directly on the head with the mallet.

Consider the reading teacher who uses data to assign students into groups, with some receiving direct reading instruction while others read silently. The teacher may be "optimally matching" to student ability but there is nothing "personalised" about the experience.[78] Moreover, the very first bullet point in the diverse-learners BES synthesis that the Ministry cites actually highlights the need for "pedagogical practices [that] create an environment that works as a *learning community*".[79]

Ideas have consequences.[80] In its official response to this report, the Ministry asked for "further clarification of what exactly is the problem with personalised learning in the [New Zealand] context". I refer the Ministry and curious readers to my field notes from my visit to the east coast of the North Island for one heartbreaking example of the problem.[80] The epilogue of this report perhaps contains another. And early on in my Fellowship, I watched one of the authors of the NZCER report make claims about what "personalised, future-focused learning" requires to a conference with hundreds of rapt educators as if the ideas were grounded in established scientific facts, rather than ideological-driven aspirations.[81] I urge the new Chief Education Science Advisor and others from the scientific community to take it upon themselves to elevate the discourse around what we really know about learning. New Zealand's educators deserve no less.

Two puzzles involving student-achievement data in New Zealand

The New Zealand education system is awash in assessment data. At the primary and intermediate school level, there are at least 10 different significant assessment tools available for classroom use, with a dizzying array of acronyms, including the Progressive Achievement Tests (PAT), the online learning and assessment tool called e-asTTle, and the forthcoming Progress and Consistency Tool (PaCT).[82] New Zealand's secondary school system is likewise dominated by the National Certificate of Education Achievement or NCEA certification programme, administered and overseen by the New Zealand Qualifications Authority (NZQA). Remarkably, NCEA comprises three separate levels, covers more than 50 different subjects (ranging from mathematics to Māori Performing Arts) and typically contains multiple standards within each subject.[83] Compared to the US system, where assessment and accountability centres predominately around English Language arts and mathematics, the expansiveness of New Zealand's assessment regimes is almost breathtaking.

One of the more heartening findings in this report, at least in my opinion, is that educators in New Zealand strongly believe that data generated by all these assessments should play a central role in their decisions. By my count, I spoke to more than 50 principals and teachers about their decision-making process and the role of data. Not a single one expressed any reservation about incorporating data into

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[78] I am indebted to my Fulbright-scholar colleague Sarah McKibben for making this observation.

[79] http://www.educationcounts.govt.nz/publications/series/2515/5959

[80] http://kuranga.tumblr.com/post/90611889126/visiting-schools-on-the-east-coast-of-new-zealands retrieved on 19 July 2014.

[81] http://kuranga.tumblr.com/post/80229775994/science-theory-and-evidence-in-education retrieved on 16 July 2014

[82] http://toolselector.tki.org.nz/ retrieved on 16 July 2014

[83] http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/_ retrieved on 16 July 2014

important decisions they were making (or made) with respect to their school or classroom. As one school principal said to me, "data is fundamental to just about everything we do".

The Ministry of Education also places a strong and to my eyes expanding emphasis on the importance of data in setting and evaluating education policy. At the highest level, the PISA[84], TIMSS and PIRLS[85] assessments provide a cross-sectional snapshot of overall student performance of Kiwi students compared to their international peers, primarily in mathematics, language arts, and science. With the introduction of National Standards, the primary and intermediate school assessment tools described above can now be used, at least theoretically, to track student achievement progress over time. And New Zealand has set a bright line goal of having 85 per cent of all 18-year olds obtaining NCEA Level 2 certification by 2017.[86]

Yet there is tension within New Zealand's education system between the various users of data. In an 'Ed Talk' video for the New Zealand non-profit organisation CORE Education, teacher Tim Kong explained the dilemma in plain language. "[T]he politicians for example who are leading this system are paying attention to the data that they need to run the whole system," which is often different from the data a teacher needs in the classroom, or the data a principal needs for the school. And so, Kong contends, "we end up having really big arguments about what they mean, even though ostensibly we all say we care about education and teaching and learning, we are looking at different data sets".[87]

I agree. In many of my conversations with New Zealand educators, I noticed that while teachers were eager to use data to make decisions at the school or classroom level, there was widespread apprehension about the use of data at the policy level. "We don't want someone looking over our shoulders at the data and telling us what to do", one principal told me. The unfortunate result is that the voices of educators who support data-driven decisions are drowned out by political noise that may falsely suggest to policymakers that educators are "anti-data". (Trust issues again.)

Returning to Kong, he offers one possible solution in the form of a suggestion to his fellow educators: They "need to be aware of the needs of the other users or people in the system and understand why we have to do it in this way, and I don't think we often explain that very well to each other". In other words, both policymakers and educators need to develop empathy for each other's respective needs. "The profession need[s] to be a bit more honest and a bit more critical", Kong says.

As an unabashed and unapologetic believer in the need for recurring, rich assessment of student learning, I admire New Zealand's deep commitment to producing robust education-related data. Yet it is almost axiomatic that while good data *may* drive good decisions, bad data will almost certainly lead to bad decisions. Thus, as I immersed

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[84] Programme for International Student Assessment http://www.oecd.org/pisa/ , refers
[85] Respectively, Trends in International Mathematics and Science Study and Progress in International Reading Literacy Study, http://www.iea.nl/ , refers
[86] http://www.minedu.govt.nz/theMinistry/BetterPublicServices/More18YearOldsWithNCEALevel2.aspx retrieved on 16 July 2014
[87] http://www.edtalks.org/video/importance-data?qt-video_page_description_transcrip=1#qt-video_page_description_transcrip retrieved on 16 July 2014

myself within the education system here simply, I started to wonder – how reliable is the key student-learning data that is informing the decisions of policymakers and practitioners? I explore this question by presenting two data 'puzzles' involving the NCEA assessment system and National Standards.

The internal-external NCEA assessment decile-disparity gap

The NCEA assessment system is a comprehensive and complex standards-based system that involves hundreds of assessments. Although it is beyond the scope of this report to fully explain how NCEA works, the explanation offered by NZQA (the agency responsible for NCEA assessment and quality assurance) provides a basic overview, with my additional explanations in [brackets]:

- Each year, students study a number of courses or subjects.

- In each subject, skills and knowledge are assessed against a number of standards. For example, a Mathematics standard could be: Apply numeric reasoning in solving problems.

- Schools use a range of internal and external assessments to measure how well students meet these standards.

- When a student achieves a standard, they gain a number of credits. Students must achieve a certain number of credits to gain an NCEA certificate.

- There are three levels of NCEA certificate, depending on the difficulty of the standards achieved. In general, students work through levels 1 to 3 in years 11 to 13 at school.

- Students are recognised for high achievement at each level by gaining NCEA with Merit or NCEA with Excellence. [Students need to "achieve" the standard to obtain credit, and merit and excellence may be awarded for higher performance. NCEA also includes unit standards but these are diminishing in number and are not covered in detail here.]

To illustrate how NCEA functions in practice, imagine a 15-year old student in Year 11 who takes a course in mathematics that, over the year, will yield 18 credits. This student would accumulate some of these credits by taking a series of "internally moderated" assessments throughout the year. Internal moderation means these assessments will be graded by their teacher or other teachers in their school, teachers who will have to exercise their judgment as to whether the student has "achieved the standard". Then, at the end of the year, the student will also take an externally moderated exam for credit. This assessment is offered on a fixed date for all students in New Zealand, and is marked by independent reviewers (usually teachers drawn from other schools). In other words, the NCEA external assessments are in essence national summative assessments.

In February 2013, the *New Zealand Herald* published a story on NCEA that included a remarkable data-visualisation tool.[88] The Herald gathered data on student performance on NCEA from 2008 to 2012 for 23 subjects at all three levels, and

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[88] Jones and Singh (2014) http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11207352 retrieved on 16 July 2014

sorted by school decile, number of entries (i.e., number of individual assessments), and type of assessment (external, internal, or unit standard). This data then was compiled into visual format, producing information that could be manipulated. The screenshot below illustrates the visualisation in static form:

Achievement rate since 2008 in 20 subjects for all deciles and NCEA levels.
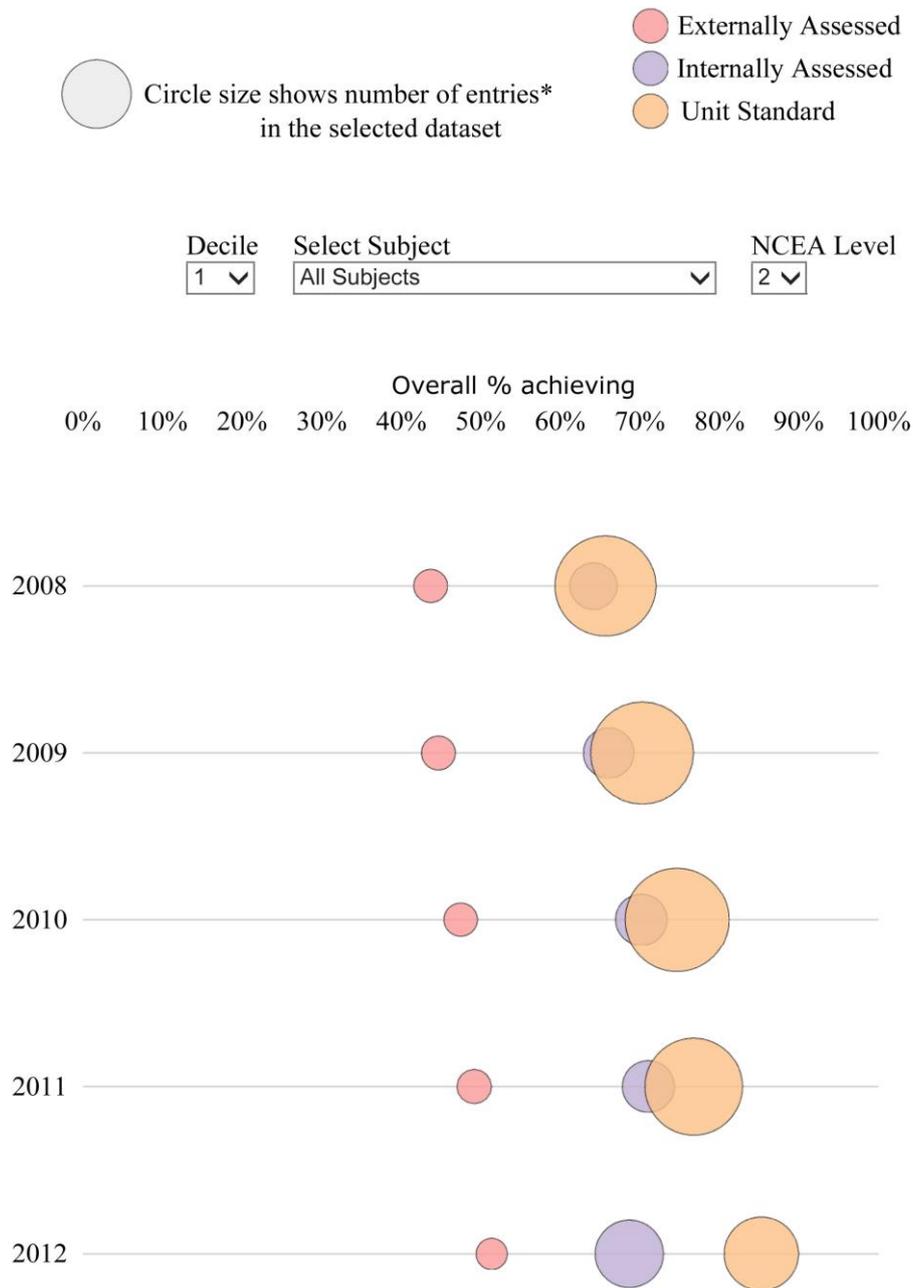
Manipulating the tool reveals an unmistakable pattern: there are large gaps in student performance depending on the type of assessment, and these gaps are correlated to school decile. More specifically, there are large gaps in performance in low-decile schools that narrow as you move to the mid-decile school range. These gaps all but

disappear in high-decile schools. The only way to fully appreciate the magnitude of the gaps is to view them online, but the following chart is illustrative[89]:

NCEA Level 2 student performance in 2012

subject	entries	Decile 1		Gap within the decile	entries	Decile 10		Gap within the decile	Decile Disparity Gap
		% achieved (or better)				% achieved (or better)			
		External	Internal			External	Internal		
Social Studies	427	31.5	70.4	38.9	825	74.2	78.8	4.6	34.3
Accounting	365	36.4	76.2	39.8	3,673	85.2	91.8	6.6	33.2
Chemistry	1,325	42.4	78.5	36.1	12,969	83	89.5	6.5	29.6
Mathematics	5,688	40.1	66.7	26.6	35,315	86	83.2	-2.8	29.4
Geography	804	45.9	73.7	27.8	7,773	83.1	88.9	5.8	22
Physics	1,020	42.7	71.8	29.1	10,933	79.2	87.9	8.7	20.4
Economics	266	33.3	60.2	26.9	5,667	80.3	86.9	6.6	20.3
History	806	44.1	67.6	23.5	5,765	85.8	91	5.2	18.3
Health	499	43.8	66.9	23.1	1,312	75.6	84	8.4	14.7
Biology	1,410	46.2	70.4	24.2	13,362	80.4	90.9	10.5	13.7
English	7,465	46.1	59.8	13.7	34,169	78.4	84.1	5.7	8
Technology	641	50.7	61	10.3	6,063	74.8	81.5	6.7	3.6
Visual Arts	1,320	83.6	76.4	-7.2	6,680	95.7	92.9	-2.8	-4.4
All subjects	*31,178*	*51.4*	*68.7*	*17.3*	*178,686*	*82.2*	*86.6*	*4.4*	*12.9*

* Entries for "All subjects" will exceed numbers show here due to ommitted subjects from chart.

This data is not cherry picked. This pattern persists across time (from 2008 to 2012), across nearly all subjects (with the lone and interesting exception of visual arts), and at all three NCEA levels. Barring some flaw in data that was furnished to the *Herald*, there is no disputing that, over the past five years, there are large gaps in student performance in low-decile schools depending on the type of assessment, gaps that are not present in high-decile schools to anywhere near the same degree.

When I first became aware of this disparity, the issue felt familiar. My initial suspicion was that New Zealand may be experiencing something similar to what happened in the US under the major federal education law, No Child Left Behind (NCLB). Under NCLB, US states were held accountable for improving student achievement, but they were free to set their own standards and adopt their own assessments aligned to those standards. The result is that while some states set high standards and adopted challenging assessments, others set the bar low and then manipulated cut scores to make it appear that students were mastering the content. This manipulation was only revealed when the federal no-stakes National Assessment of Education Progress (NAEP) exams were administered – NAEP is considered "the nation's report card" in the US – and the disparity between states was made obvious. Some states were claiming 70 to 80 per cent of their students were proficient in ELA and maths, whereas NAEP showed their proficiency at about half that rate (if not worse).[90] And this difference was often most visible in states serving a large population of students living in poverty.

In other words, some 'low-decile states' tended to overstate performance on their own, 'internally moderated' state assessments. The federal, 'externally moderated' NAEP exam exposed this, and highlighted a real policy design flaw. Indeed, the US is presently engaged in the Common Core standards initiative in part to set a level playing field when it comes to standards and assessments.

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[89] Data provided to author by Harkanwal Singh of *New Zealand Herald* on 13 July 2014
[90] Barth (2006)

In New Zealand, the issue is whether the internal-external "decile-disparity gap", as I am calling it, is a genuine problem that calls into question whether the progress being made toward the 85 per cent NCEA Level 2 target is meaningful. When the *Herald* published its story, Professor Gary Hawke, who chairs the group responsible for monitoring the validity of NCEA, was quoted as saying the performance disparity between internals and externals across deciles is an "incidental outcome" of NCEA, and "no cause for concern". Similarly, education expert John Hattie suggested the problem might be in the high-decile schools, because they're creating internal exams that too closely mimic the material assessed on external exams. Yet, these explanations appear to contradict what NZQA itself says about the relationship of external to internal assessments:

> External assessment ensures we get a nationally consistent snapshot of student achievement in a subject – everyone does the same task at the same time under very similar conditions. *This also provides one basis for checking the consistency of internal assessment.*[91]

Indeed, as NZQA further explains, "external assessment results also provide NZQA with a measure of student ability that is used to monitor the quality of each school's internal assessment processes and judgements".[92]

These statements from NZQA about the assessments they administer strike me as reasonable. While external assessments do not test exactly the same content as internal assessments, one would expect – perhaps even hope – there would be relative alignment within a subject. It seems to me students have a right to expect that their performance on internal assessment will provide them with meaningful guidance on whether they are prepared for external exams. Yet the data suggest this is less likely to be true for students in low-decile schools than in high-decile schools. This would appear to present a major issue of equity.

Michael Johnston, a senior education researcher at the Victoria University of Wellington and former NZQA official, offered two hypotheses for what he calls the "the steeper gradient of students' performance across the decile range for external assessments than for internal assessments". His main hypothesis is that "students at high-decile schools get more practice in the exam format than those at low decile schools. This is an empirical fact – the proportion of standards that are externally assessed is much higher for students at high-decile schools than for those at low-decile schools".[93]

As a secondary hypothesis, Johnston believes that students in high-decile schools might possess more "cultural capital" and thus cope better with external exams. He thinks students in high-decile schools might also be able to get extra time and other special conditions during external exams "because they have access to psychologists

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[91]   http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/understanding-ncea/the-facts/factsheet-8/ retrieved on 16 July 2014 (emphasis added)
[92] Idem.
[93] Michael Johnston, e-mail correspondence dated 18 July 2014

saying [they should] get accommodations, access students in low-decile schools might not have".[94],[95]

All that said, Johnston acknowledges that "there may be some truth" to the hypothesis that teachers in low-decile environments may be more generous in their marking of internal assessments. Johnston suggested this may be because of the "tendency of teachers to think in normative terms, and give their highest grades to their best students. So a student might get an excellent in a low-decile school [that might only] be merit in a high-decile [school]".[96]

One deputy principal who teaches science at a low-decile rural school proposed another hypothesis that warrants consideration. In her estimation, there is great variety in the difficulty levels of particular standards *within* any NCEA subject. In the subject of science, for example, she explained that "explaining basic facts about the physical world is not the same as understanding genetics," yet students can make the same progress toward achieving NCEA qualification by obtaining credits and taking assessments that vary greatly in what they demand that students know and understand. The result is that teachers can create pathways for NCEA certification for students that vary tremendously in their rigour. "So how do employers know if students took easier credits? How do parents know?", she asked rhetorically. Instead of setting a firm bar around academic expectations, the bar moves depending on the student.

What lends credibility to this hypothesis is that this form of credit manipulation would explain the wide variation in student performance on internals versus externals as a function of school decile *even if internal assessments are being moderated correctly*. If students in low-decile schools are being steered toward less rigorous internal credits by their teachers at a rate higher than in high-decile schools, this would explain why the same students would struggle on the uniform national external exams. What's happening, according to this hypothesis, is a form of selection bias: teachers are selecting different standards for their students to meet; the selections correlate with school decile; and thus students in New Zealand are not being held to the same expectations across the country.

There are other hypotheses that may be worth investigating as well. Numerous educators I spoke with suggested that there are issues around the internal moderation of NCEA exams (I'll take up the issue of internal versus external moderation in the next section on National Standards). For its part, NZQA furnished me with the following list of potential factors that might influence outcomes:

- Conduciveness of home environment to study
- Parent/Teacher expectations

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[94] Michael Johnston, personal interview, 8 July 2014
[95] After reviewing a draft of this report, the Ministry and NZQA stated "changes [to the accommodations policy were] implemented earlier this year – schools no longer have to obtain a psychologist's report as they can gather defined school based 'Alternative evidence' instead". (Ministry official response, 18 July 2014). I cannot say whether this solves the underlying problem Johnston identifies or compounds it by expanding the routes through which some students but not others will obtain accommodations (though I have my suspicions).
[96] Michael Johnston, personal interview, 8 July 2014

- Course/programme structures

- Perceived difficulty of an external [assessment]

- Opportunity to re-submit internals (under precise rules)

- Variety of study skills for external assessments

- Students not needing the credits when externals come around

- School's focus

- Exam preparation

- Need to work/look after siblings while parents work[97]

It is not clear to me why some of these factors should influence the *gap* between internal and external assessment (whereas they quite obviously might affect *overall* performance), but they at least present additional hypotheses to test. And to their credit, the Ministry and NZQA appear to be looking into these issues:

> The concerns raised in [this] report about the data are very important. The hypotheses related to teaching are understandable given the principles of cognition and learning [contained in this] report…The portfolio nature of the NCEA and the availability and use of data are enabling us to unravel and test these hypotheses.[98]

I look forward to seeing what explanations emerge and what, if anything, they feel should be done to address the decile-disparity gap.

There are many virtues to the NCEA system. Providing students with multiple pathways to demonstrate achievement is certainly a laudable goal. But if the bar is being manipulated to create a false sense of improvement for certain students, particularly those from underserved communities, eventually reality will set in as employers, higher education providers, and others start to see persistent gaps in ability. I think of the bright, tattooed student at a decile three high school who managed to achieve NCEA Level 2 despite attending class only 40 per cent of the time. "There's a lot of students like us," he said. "We aren't challenged, so we don't bother to show up." The official numbers count this student as a success toward New Zealand's 85 per cent achievement target. In reality, the system is letting him down.

Moderation of Overall Teacher Judgments relative to National Standards

In 2010, New Zealand adopted mandatory National Standards for all public primary and intermediate schools. As envisaged, the National Standards describe what students are expected to have learned in reading, writing and numeracy at the end of each year of school. Unlike NCEA, however, there are no national standardised assessments directly tied to National Standards. Instead, students are assessed

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[97] Private correspondence from Karen Poutasi, chief executive of NZQA, on 26 May 2014
[98] Ministry official response, 18 July 2014

internally by their teachers based on their teachers' "Overall Teacher Judgment" or OTJ as to whether students are above, at, below or well below the standard.[99]

To describe this policy initiative as controversial would be an understatement. National Standards emerged as a topic of vigorous commentary in virtually every primary school I set foot in. As one principal put it, National Standards "have dominated every conversation we've had for the past three years". As an outsider who was not in New Zealand when National Standards were adopted, I spent a great deal of time assiduously *avoiding* learning the history behind National Standards or their initial roll-out, lest this topic consume my conversations. Instead, given that National Standards are at present the axis around which assessment and instruction revolves, the question that I explored was simply, how reliable is the data?

The answers were all over the map. "The real problem with National Standards is that they are neither national nor standard", one principal said to me (as did many others). A significant number of the primary school educators I spoke with expressed the view that because National Standards depend upon internally moderated OTJs, and because this moderation is inconsistent across the primary school sector, the data generated by National Standards is generally unreliable. The view was even harsher among secondary school principals, all of whom said they conducted their own assessment of students entering from primary and intermediate schools. Indeed, a recent poll of New Zealand educators by NZCER found that a remarkable 87 per cent of principals and 70 per cent of teachers strongly disagree or disagree that National Standards data provides a reliable picture of student performance.[100]

And yet, despite the heated rhetoric, many school leaders quietly acknowledged to me that National Standards were helping them drive improvement in their schools. One principal explained to me how National Standards generated data that helped him identify issues such as low maths performance for students in Years 3 and 4. Many other principals told me similar stories about how they used National Standards data to have hard conversations with teachers about their effectiveness ("the Standards shield me," one principal said).

The paradox of National Standards is that they are distrusted by educators generally yet acted upon locally. Is there a way to resolve this tension? While the NZCER poll found principals and teachers were distrustful of the data, both groups endorse the idea that "the Ministry should support neighbouring schools to work together to moderate their OTJs" (with 57 per cent of principals and 55 per cent of teachers strongly agreeing or agreeing).[101] The Ministry might view the rollout of the new PaCT tool as an opportunity to (gently) engage in that effort hand-in-hand with schools to generate valid and reliable data that will be trusted and used.

The decision dilemma

One of my goals during my schools visits throughout New Zealand was to develop a "List of Education Decisions". More specifically, I wanted to bring up and compile a

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[99] http://nzcurriculum.tki.org.nz/National-Standards/Key-information/Questions-and-answers
[100] Wylie and others (2013)
[101] Wiley and others (2013)

comprehensive list of specific problems that educators were grappling with, and synthesise some of the more common concerns. Moreover, I planned to use this report to highlight these issues for the education policymaking and research community, and perhaps see them work together to tackle some of the problems on the list.

As I conducted my school visits, however, I discovered an unexpected challenge: Identifying actual decisions. This proved difficult for multiple reasons. First, some schools were reluctant to identify problems or issues with which they were struggling, perhaps understandably, given my unusual status as outside observer. Second, even when problems were identified, rarely did schools settle on a single solution or intervention, with most instead employing a portfolio of strategies ranging from minor tweak to major overhauls. Third, identifying the timing of decisions with specificity often proved impossible, perhaps reflecting the reality that school leaders do not have the luxury of time to track each and every thing they decide to do. Finally, it was *very* rare to find schools that evaluated outcomes of decisions in any formal or even semi-formal manner.[102]

The research literature suggests I am not the first to encounter this difficulty around decisions. For example, a three-year longitudinal study of decision-making in one US school district identified only 45 instructional decisions that could be identified with specificity and evaluated empirically. Citing the work of respected educator, the late Professor Carol Weiss, the authors of the study explained the complexity of the decision process they encountered:

> Many decisions are not made through formal deliberations in which key decision makers are at the table, considering alternatives and setting policy. Rather, policy often emerges through a series of conversations and actions in which ways of thinking about problems emerge, and small steps set the organization on a particular course, closing off some potential avenues for action and narrowing the range of potential solutions that it is possible to envision or pursue. In this way,[] decisions 'accrete' over time as these small steps add up to a policy decision regardless of whether formal action is taken.[103]

This accurately describes my experience in the majority of my meetings with school leadership teams. Although problem identification might be specific – concern about an increase in pastoral incidents, for example, or sliding student achievement data on Year 5 maths – school leaders rarely identified a single intervention with a defined start and end date. Far more frequently, the problem identification was *prelude to a conversation* with teachers and taking small, incremental efforts toward changing their mindsets and expectations. As one primary principal said, "people hold on to their beliefs. If you tell them what they believe is wrong, they will just hold on more powerfully than before".

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[102] The Ministry of Education echoed this observation in its official response to this report: "[I]ssues include schools having difficulty identifying the urgent problems [and] challenges; adopting multiple strategies and use of multiple programmes [and] resources; and little evaluation of effectiveness". Ministry official response, 18 July 2014

[103] Coburn and others (2009)

The Ministry of Education, after reviewing a draft of this report, suggested that the new Investing in Educational Success (IES) policy might help ameliorate some of these challenges:

> There is potential for Investing in Educational Success to tackle the negative effects of a highly decentralised schooling system. Examples include the policy design around more functional relations between schools to support the sharing of practice, increasing the conditions for developing trust, knowledge, and the critical uses of evidence within and across schools.[104]

I agree with the Ministry. To the extent schools and educators are grappling with similar issues, the IES policy as I understand it seems a perfectly reasonable approach to build networks of collaboration within the education system. The fact that the current government is investing $359 million towards this end is something the education sector should embrace. Educators, trust me when I say that the Ministry wants your help fleshing out this policy – please consider taking them up on their offer.

At the local level, Pete Hall, the acting principal of an urban primary school in Auckland, lists eights factors that he believes drive decisions in education: (1) convenience; (2) capacity for complexity; (3) inertia; (4) sense of direction; (5) peer pressure; (6) framework and process; (7) emotional stories; and (8) existing perspectives that are hard to change. In contrast, Hall lists only one factor that he thinks does *not* drive education decisions: Having the right information. "There's more than an implied correlation between the process of good decision making and the making of a 'good' decision," Hall writes. "If we're measuring what matters, then we're really looking to measure the quality of decision rather than the process. They are not the same thing, yet I don't know how we can manage their relationship without tainting something along the way".[105]

My school visits generally accorded with Hall's description of the decision-making processes in schools. Thus I admit I failed to compile the list I had hoped for. But having said that, my research did bring out two relatively specific issues that were common to multiple schools and that, as part of the decision-making conversation, might benefit from additional attention from policymakers and researchers: the acquisition of oral-language skills and the Numeracy Project.

Concerns regarding oral-language acquisition in young Kiwis

On at least four separate occasions without prompting, school principals or senior leaders from primary schools scattered around New Zealand told me that they are observing a marked decline in the oral-language abilities of their incoming students. In one decile 10 school in Auckland, for example, a deputy principal told me her new students "couldn't speak in sentences," which meant in turn "they couldn't write in sentences if they couldn't form [the words] orally". Some subsequent phone calls to school leaders in similarly situated schools confirmed they too were seeing this as a growing area of concern.

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[104] Ministry official response, 18 July 2014
[105] http://kuranga.tumblr.com/post/88310342576/what-really-influences-decisions

The same deputy principal then explained how her school worked through its decision-making process. Understanding that their impressions were anecdotal, they wanted to assess whether the impression was accurate, but "this made us notice that there aren't many tools to measure oral language ability. And some that [do exist] are incredibly cumbersome". The deputy principal candidly admitted they did not really investigate whether existing research could help them decide what to do. Instead, they decided to put in explicit teacher professional development around this issue into their strategic plan, using a resource called First Steps, apparently developed in Australia.[106] Why this particular resource? "We'd used it in the past, it's one of the few supports out there," the deputy principal said, and "it aligns with our philosophy and vision".

In contrast, other educators developed different hypotheses as source and potential solutions to this problem. A principal at a decile 1A rural area school, for example, argued that "the kids aren't talking as much with their parents, it's just that simple". As you might expect, this principal believes any intervention should be targeted at parents. A school teacher in an urban decile 10 primary school agrees that parents should be the focus, but for a very different reason, as she suspects the parents are letting their children spend too much time on digital tablets.

Whether oral language acquisition is a growing problem in New Zealand or not strikes me as the sort of issue that should be tackled jointly between the Ministry, educators, parents, researchers and others. Working together, these groups could investigate the following questions: Do we know whether students in New Zealand are truly entering school with lower oral language skills? What does the existing research say about what approaches are effective in addressing these deficiencies? What resources presently exist that are aimed at raising oral-language ability? Is it possible to conduct some rapid research to test the competing hypotheses as to why language skills are slipping? If the problem is confirmed as genuine, then the Ministry should take action and allocate resources to support primary schools facing this issue. In so doing, the Ministry might truly develop policy "from the bottom up" that connects to real issues schools are presently facing. I believe that this will be well received by the sector.[107]

Suspicions around the Numeracy Project

Schools in New Zealand, like so many schools worldwide, are wrestling with ways to improve student achievement in mathematics in the middle years of education, particularly in Years 5 to 8. Many principals and teachers expressed strong views around New Zealand's Numeracy Project in particular.108 At one urban decile 10 school, for example, the lead teacher responsible for mathematics suspected that the

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[106]   http://det.wa.edu.au/stepsresources/detcms/navigation/first-steps-literacy/?oid=MultiPartArticle-id-13602018

[107] For its part, the Ministry appears to agree this is an issue: "Ensuring appropriate levels of oral language (and specifically vocabulary development) is a major developmental challenge, with low vocabulary levels limiting school learning. There is a need for more data which profile patterns over the transition to school. The Growing up in New Zealand longitudinal study is very well positioned to provide these data". Ministry official response, 18 July 2014

[108] http://nzmaths.co.nz/numeracy-projects. Although technically this programme is plural (Numeracy Projects), virtually everyone I spoke to referred to this initiative in its singular form (Project), so this report adopts common usage for reference.

Numeracy Project had "swung the pendulum too far" in teaching strategies to solve maths problems rather than developing mathematical content knowledge and fluency in algorithms. A secondary school mathematics teacher with master's degree in mathematics was even more critical:

> They can say what they want, but repetition is key [to learning basic maths facts]. We almost need to start from scratch with students, and undo bad practices…Their basic number skills are bad. They come in and cannot divide at all. They do not see multiplication as multiple addition. Kids [are being given] too many strategies, they can't decide which is better. In maths, there should be freedom…but there is also order.

Multiple school principals expressed a desire to improve teacher content knowledge around math. The principal of one rural area decile 1A school decided to tackle the problem by hiring an external consultant to provide professional development. Three years into the intervention, I asked this principal whether this decision was paying off. "In terms of teacher voice, there's improved confidence", she said. "But I can't do comparative data [in terms of student achievement] because we've had an influx of students [note: two other schools in the area recently closed]. I'm trying to track the kids who've been here but it's very time-consuming to disaggregate the raw data".

That educators are struggling with mathematics instruction is not headline news. And I have the sense that the Numeracy Project is already being (quietly) phased out.[109] But if the concerns regarding the Numeracy Project are justified, investigating whether and how it went wrong would likely generate important guidance for future efforts to improve maths instruction. This is yet another effort that might be taken up by the new Chief Education Science Advisor.

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[109] After reviewing a draft of this report, the Ministry offered the following comment: "There are a number of studies locally which reach similar conclusions to those in the report, and which are consistent with international studies. These conclude that there is a need for more developed and fluent number knowledge in the early years and more systematic teaching in specific areas such as place value and early algebraic knowledge". Whether this confirms the Numeracy Project is being phased out or not I'm not entirely sure.

CONCLUSION

In this final section, I offer two separate recommendations, one designed to build trust, the other designed to foster educator engagement with existing scientific resources. I conclude by attempting to bring together the many different themes and issues touched on in the report by describing the 'education system' using a scientific metaphor.

Recommendations to the Ministry of Education

After working in public policy for more than eight years, I am convinced of one universal truth: Actual policymaking demands concrete proposals. For that reason, I tend to eschew recommendations that declare that someone should "strengthen X" or "support Y" without explaining *how* to strengthen or support X or Y. Here, I've described my two recommendations with some specificity, but they should be considered the starting point of a policy-formation conversation, not the end point. They are ideas that policymakers and educators might work from if they find the underlying goal worth pursuing.

Create new Sector Stewardships

If a key challenge facing New Zealand's education system is the lack of trust between 'the Ministry' and 'the Sector', then rebuilding trust is paramount. No single initiative or programme can do this of course, and progress will be measured over years, not months. But after spending seven months asking educators what support they most wanted from the Ministry, the most common response was *to be understood and supported*. As one principal put it, "It'd be nice to have someone from the Ministry ask the questions you're asking, and then serve as a resource to connect us with others who can help". Paula Hogg, the chair of the Board of Trustees of one Auckland school, put it more bluntly:

> Ministry officials need to get out of their offices and visit some schools. Actually come and talk to us, and find out the issues we're facing. We have a voice and would like to be heard. There's no conduit for that – it's very one-directional. We have to change this – and we have the technology now to do that. It's more a mindset barrier.[110]

Perhaps Gary Hawke described this most eloquently in suggesting that, "What's needed is a project that foster[s] mutual respect among policy developers and reflective practitioners [and creates] a common belief that they can interact productively but that neither can do the other's job, [and] a major outcome of productive collaboration would be knowledge creation that can inform practice and create more options for policy".[111]

Toward that end, I propose the Ministry create new **Sector Stewardships**. The goal of this program is to provide Ministry employees with the same sort of experience this

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[110] http://kuranga.tumblr.com/post/88343838466/making-decisions-as-a-school-board-trustee-in-new
[111] Emeritus Professor Hawke, private correspondence, 5 May 2014

fellowship provided me, and build a bridge between policy and practice. The programme might work as follows:

- Ministry employees would be asked a single question: Would you like to be a Sector Steward? Those that answered yes would be entered into programme. The Sector Stewardship programme must be voluntary (to encourage broad participation) and simple (to mitigate bureaucracy).

- The Ministry would survey all New Zealand public schools to ask them a single question: Would you like to host a Sector Steward? Again, participation would be entirely voluntary. (The response to this question, and in particular any change over time in affirmative responses, might itself generate an interesting data set.)

- Sector Stewards would then be randomly matched to their host schools. Randomisation is important so that Ministry employees see the diversity of questions and decisions in local context and without pre-existing familiarity and potential bias. Insight often comes from observing the unfamiliar.

- Sector Stewards and their hosts would then arrange, on their own and without oversight, school visits of one to three days. School hosts would lead in the design of the visits.[112]

- Importantly, and this point cannot be emphasised enough, the stewardships would be "no stakes". Stewards would *not* be tasked with writing a report or memorialising their findings in any formal way. This message would need to be underscored in every missive related to Sector Stewardships to have any hope of securing school participation.[113]

- Both schools and Stewards would understand that the only deliverable item in the programme would be this: Stewards should return to their Ministry offices with exactly one issue or question that they observed the school grappling with. Stewards would then endeavour to help the school think through the issue, and perhaps connect educators from their host schools to Ministry resources that might help the educators in some way. This would be done in collaborative fashion with the aim of building a human relationship between the Ministry and the sector, one school and one employee at a time.

What might this programme cost? If every public school in New Zealand agreed to host one Sector Steward per year (which is ambitious), and if every school visit was

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[112] During my 22 school visits, I discovered that schools welcomed me in a variety of ways. Some schools developed strict agendas, others kept things loose. Some wanted me to see the best they had to offer, others wanted to provide a complete picture "warts and all". Some schools voluntarily offered to let me speak with students in private, others held meetings in group settings. Some schools offered me a drink after a long day, and yes, some were suspicious and wanted to know if I had an ulterior motive. There are hints of school culture that emerge when new entrants move into their environment.

[113] After reviewing a draft of this report, Dr Alton-Lee, noting the lack of formal engagement with the research community, worries that "if the conversation becomes binary between the Ministry and the sector" and does not include "those who bring demonstrated external and collaborative R & D expertise into accelerated improvement and those broker community funds of knowledge – then we could be stewarding a 20th century rather than a 21st century system". On the whole I agree, but for administrative simplicity, I recommend the Ministry first humanise its relationship with schools and *then* bring the scientific and research community into the conversation. The foundation of trust will need to be laid brick by brick.

budgeted at $1,000 (which is aggressive), this would make the baseline budget for the Sector Stewardship programme approximately $2.6 million per year. Assuming some incidental personnel costs for administering the programme, a total estimated budget of $3 million per year seems reasonable. While this is not a trivial sum, if viewed as an investment toward rebuilding trust and relationships between education policymakers and practitioners, my hunch is this could yield an immeasurable return.

Use digital technology to promote the Best Evidence Synthesis programme (Digital BES)

In my view, New Zealand's Best Evidence Synthesis programme represents a remarkable and impressive achievement. With its emphasis on serving as a "knowledge broker" that attends to "empirical evidence about the relationship between education influences and outcomes for learners", and its focus on developing "smart tools" that can be adapted for use by educators in their local contexts, BES is a compelling and comprehensive effort to synthesise education research and evidence with practical application. This major resource deserves to be leveraged to the maximum extent possible

When I spoke to New Zealand educators about the BES programme, most acknowledged the high quality of the work and the person most responsible for its creation, Dr Adrienne Alton-Lee (described as a "national treasure" by one educator). Yet, at the same time, many educators admitted they simply had no time to read through a full BES written compendium of more than 100 pages. Many found the shorter BES summary exemplars more useful, but even here, engagement was passive insofar as educators could do no more than read the exemplars and then reflect on their practice. There is no obvious path for a sustained *conversation* around the BES.

To address this, I recommend the Ministry use digital technology to improve the usability of BES work-product and create opportunities for collaboration and conversation related to its implementation in the field − in other words, create **Digital BES**. Here are three suggestions on how to bring BES into the digital age:

- **Hire a data-visualisation designer.** Good data visualisation makes research come alive for educators and engages them in ways that reading a report summary simply will not.[114] The BES summaries are rich with information that could generate any number of interesting tools that teachers could use. And new Digital BES projects could be designed with data visualisation in mind, ensuring the proper data is collected from the outset.

- **Hire a digital-communications director to promote BES using social media and other technology.** The advance of social media is creating a wonderful method for penetrating the walls of schools and classrooms to

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[114] When I showed secondary-school teachers the NCEA data-visualisation tool built by the *New Zealand Herald*, all conversation immediately stopped. Without exception, they became engrossed with manipulating the tool and its data.

interact directly with teachers.[115] Digital BES should harness these tools to more effectively communicate with educators and serve as knowledge broker on their behalf. I recommend the Ministry hire a communications officer for Digital BES who is fluent with social-media communications and innovative in their approach to disseminating information.[116]

For example, elsewhere in this report I mention my appreciation for the BES exemplar on creating collaborative classrooms of mathematical inquiry (see Appendix 2). This particular BES exemplar references a teacher known only as Moana. A creative communications director for Digital BES might think about finding this teacher and, if she is willing, connecting her to other educators who might be interested in learning directly from her how she changed her teaching practice as a result of using the BES. Further, in this fantasy, perhaps these teachers would in turn seek out the researchers who participated in this BES to learn more from them directly, thus strengthening a bridge between the teaching profession and the tertiary sector. This is how good ideas spread.[117]

- **Develop an evidentiary base to support the science of effective education science communication.** As digital strategies are employed to elevate the profile of new and existing BES work-product, the Ministry should employ the tools of social science (and engage with social scientists) to evaluate which strategies were most effective at influencing decisions and spreading the use of good education science and evidence. In so doing, Digital BES will not only be better positioned to spread the powerful knowledge of its substantive work product, but also develop an evidentiary base that other nations might rely upon as they embark upon similar science-communication efforts around education. New Zealand may already be an international leader for science in policy – there is an opportunity to become the leader for science-communication policy as well.

What is an Education System?

This report attempts to cover broad ground. At various stages, issues related to science, knowledge, evidence, cognition, *cultural* cognition, public policy, education policy, education practice, trust, decisions and data are touched upon in some degree. So I will conclude by stepping back to see the big picture, to look at all these things in the broader context of the abstract concept we use to layer over all these activities, and to ask – just what is this thing we call the "education system"?

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[115] Before I arrived in New Zealand, I started following multiple educators on Twitter, a decision that paid many dividends later, when many invited me to visit their schools, attend local conferences, and even stay in their homes. Just as helpfully, streaming online conversations such as #edchatnz on Twitter provide a medium through which one can observe teachers talking and collaborating with one another in real time. And on occasion my Kuranga blog appeared to generate rich conversations among teachers and other members of the New Zealand education and science communities.

[116] Happily, Dr Alton-Lee who oversees the BES Programme, welcomes this particular recommendation and notes, "each implementation of the BES advice of the 'what' and the 'how' reveals what can be possible. [The report's] recommendations provide a valuable opportunity to get deeper engagement with what is at stake and what might be possible in the policy space going forward". Correspondence dated 18 July 2014

[117] Gawande (2013)

This vexing question is not easy to answer. Indeed, during my time within the Ministry I observed people within the "system" subgroup grope for their own understanding. We know the education system exists, yet defining the contours with precision is very hard, perhaps even impossible. We know policymakers, educators, parents, students and so many others are part of the system – but to what degree? All of the decisions and policies and data and beliefs described in this report perhaps provide a window into this system, but the picture is incomplete, the boundaries cannot be seen. We struggle to know exactly what we're looking at.

We might contrast our difficulty in describing the contours of the education system by comparing it with another system with relatively precise boundaries, one that I think is somewhat easier to understand: The Prison System. There is very little question about who sits at the centre of *that* system. Indeed, some postmodern philosophers of education have gazed upon the prison system and the education system and concluded they are essentially the same thing, and thus urged we quite literally destroy the education system, that we "de-school" society.[118] The slightly more modern gloss on this argument is to describe the education system as comprising factories producing widgets, and therefore suggest we should *disrupt* the system using modern technologies.[119]

The commentators who argue schools are like prisons or factories highlight to me the danger of philosophy and theory interfering with the capacity to see reality. Schools are not like prisons nor are they like factories. Having spent the last seven months of my life visiting them, I can safely report that most schools in New Zealand are joyous places, filled with laughter and the "bright eyes" of learning.[120] There is a reason why teachers worldwide accept far less in financial compensation than the overwhelming workload of their jobs would otherwise demand. They are compensated in other ways. They know it.[121]

So, when I think of the abstract concept that is the education system, I do not see the learner at the centre. There is no centre where we can put the learner and even if there was, I would advise the learner to avoid going there.[122] Instead, I submit that our education, and the education system that is primarily though not exclusively responsible for delivering our education, is something we *feel*, something we *experience*, yet something we cannot *see*. We are simply *comprised* by our education and the system that supports and surrounds it.

How can we describe something we cannot fully see yet we know surrounds us? It was only as I completed the drafting of my report that I realised that which should have been obvious to me all along – we use *science* to describe that which we cannot directly observe but nonetheless know to exist. And so I hereby invoke a scientific metaphor:

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[118] Illich (1970)
[119] Christensen and others (2008)
[120] http://www.ted.com/talks/benjamin_zander_on_music_and_passion
[121] We should still pay them more than we do.
[122] Only a curmudgeon would note that, despite every intention to the contrary, the idea that learners should sit at the centre of a complex system and self-regulate their learning shares some underlying similarities with the Panopticon prison first proposed by Jeremy Bentham and later explored in detail by Michael Foucault. (Foucault 1977)

Education and the education system are like atoms. Atoms cannot be seen. Yet they literally make us who we are. Every great teacher we had, every "a-ha!" moment we experienced, every time we learned something new – I submit these were tiny atoms combining to shape who we are individually. Not only that, I contend that because we had these experiences with friends and classmates in these remarkable places called schools, the atoms of our education further combined to shape us collectively, to shape our cultures and our countries, to bind together to form molecules and elements with all the variance we find on the Periodic Table. Education binds us together as surely as atoms do.[123] They scale across everything that makes us human.[124]

Please consider this report my tiny, less-than-a-quark-sized contribution to the marvellously interesting atoms, molecules and elements that constitute the New Zealand education system. Now I will put away my microscope.

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[123] Arguably just about everything John Dewey wrote regarding education and democracy is premised on this notion.
[124] The Universe in Scale. http://htwins.net/scale/

EPILOGUE: THE SYSTEM IN REFLECTION – WHO HOLDS THE MIRROR?

"So, what do you think? Does New Zealand have a good education system?"

As my fellowship concludes, various teachers, parents, and friends asked me to respond to this incredibly complex and impossible-to-answer question. My typical response was simply to say, "I don't know", and then move to safer conversational ground. But after spending seven months here, and after visiting just under one per cent of New Zealand's schools, and after spending nearly every waking minute trying to understand this country and its history and the complicated relationship between education, knowledge and democracy, I have formed a few opinions, however biased and misguided they may be. And so I'll say this:

New Zealand's education system is strong, and rightfully a source of national pride. The best public schools I visited here rival the quality some of the most exclusive and selective private schools I've seen in the United States. The fact that many of these schools are capable of charging large sums to admit fee-paying international students (at least at secondary level) is perhaps proof that I'm not alone in this opinion. Perhaps more importantly, the dedication of principals and teachers to their craft, to providing the best possible education to the majority of students in their care, was apparent in nearly all of my school visits and conversations. New Zealand's educators on the whole should be held in high regard, and celebrated.

At the lower end of the school-decile spectrum in particular, New Zealand has much to be proud of, at least relative to the US. In the middle of writing this report, I spoke with a colleague of mine back home about how impressed I was (and am) with the relative quality of the schools serving students in both urban and rural high-poverty environments. "How do they do that?", she asked. I do not know. Nor do I know why the public schools in the high-poverty areas of New Zealand look so very different from most public schools in high-poverty environments in the United States. By and large, they are healthier, happier schools. This too should be celebrated.

There are two moments, however, that encapsulate my conflicted feelings about my experience here. The first happened midway through my fellowship, in week 10 of the first term of the school year, when I visited a high-profile decile one primary school widely regarded as a leader in its use of digital technologies. During a quick classroom visit, I asked a student who'd spent the entire term studying native trees whether she could tell me a fact about them without looking at the Internet or the Google document she'd created.

She paused for a moment, looked at me, and said, "They have… leaves?"

Now, any student surprised by a pop quiz delivered orally from an unexpected stranger with a strange accent might be forgiven for not being ready to provide full evidence of his or her learning. But when I later mentioned to the deputy principal of this school my concern regarding this student's inability to articulate basic facts about New Zealand's native trees, I was accused of bringing "middle class values" into this school. I exclaimed: "But surely if this student has any hope of attending university,

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they need to learn facts, and be able to recall them when asked!" Which is when the deputy principal replied, "Well, of course that child isn't going to tertiary".

That child appeared to be nine years old.

Months later, this incident still casts a shadow over my thoughts and reflections. On the one hand, steeped in my own cultural values, I feel distraught that this educator would assume higher education simply wasn't in this child's future. Yet, New Zealand is not the United States, and befitting this nation's more egalitarian ethos, the people of New Zealand seemingly do not assume higher education is the key to unlocking life happiness. So was it proper for me to feel outraged on this child's behalf – or was I simply unable to see around my own cultural values and assumptions?

Which brings me to the second and far warmer incident that happened when visiting a decile 10 primary school on that same tour. Shortly after I arrived, the principal of the school walked me into a classroom of 25 to 30 students aged six and seven. The moment we walked in, I was overwhelmed by the incredible diversity of the children sitting in front of me. Whatever questions I had planned to ask the teacher were quickly jettisoned as I instead asked them to say hello to me in a language other than English. I promptly received cheerful greetings in Afrikaans, Fijian, Filipino, Indian, Japanese, Korean, Mandarin, te reo Māori, Punjabi, Spanish and Tongan.

In this single classroom, the abstract phrase "pluralistic society" was made real. Here were kids from an incredibly diverse array of cultures, each with its own language, learning and playing together. Through these activities, they will form friendships and bond together and in so doing build the culture of this still-emerging nation. They will become Kiwis. This is New Zealand's future, and I find it inspiring in ways that I struggle to articulate. And then, I think of my country, a nation forged by immigrants, and how it once offered similar promises and inspired similar hopes. Does it still do so today?

I don't know how to even begin to answer these questions. So I think instead about what one friend and colleague at the Ministry of Education told me after I relayed the stories above: "What you are doing here, Ben, is holding up a mirror, and asking us to look at ourselves." I'd like to think that's true, although I'm deeply uncertain. But I know this much: New Zealand held up a mirror of its own. And I'm still trying to understand what I see.

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APPENDIX 1

28 February 2014

MEMORANDUM

TO: [REDACTED]
FROM: Benjamin Riley
RE: An alternative vision for education in the digital age

The predominant vision for digital learning usually clusters around variations of the following themes. As we move into the 21st century, we must accept that children are digital natives and reform our education system accordingly. Pedagogically, we should eschew rote learning and instead personalize learning to meet learners' individual learning styles. The role of teacher must evolve from providing direct instruction to instead facilitating learners' natural aptitudes so they will self-direct their own learning. Our schools should likewise be transformed to become modern learning environments; we need fewer walls, more laptops (or iPads or other devices students bring to school themselves). We should stop demanding that learners memorize specific facts – we have Google now for that – and start focusing on developing the real skills they will need for the information economy, such as critical thinking and collaboration.

There's just one problem. There is very little evidence to support any of these claims. In fact, the academic literature is replete with studies of various attempts to improve education outcomes using particular technologies, only to find that they rarely have any measurable positive impact on student achievement. At best, the research (and anecdotal reports from educators) suggest technology can help improve student engagement, but this alone seems insufficient to justify the tremendous amount of hype – and financial investment – related to digital learning.

There is, however, an alternative vision. To understand what it might look like requires brief background on a field that may appear on first blush to have little to do with digital learning.

In the past 25 years, tremendous breakthroughs have been made in cognitive science, the science of learning. We now know that, as a species, our brains function in very similar ways. We all essentially have two memory systems, a short-term "working" memory that is limited and relatively lazy, and a long-term "storehouse" memory that contains the residue of our thoughts. The more facts we can store in our long-term memory (particularly at early ages), the better equipped we are to use our short-term system for critical thinking and problem solving. And we build our long-term memory through guided practice and assessment, led by experts who use effective techniques – such as questions, problems, examples, stories and mnemonics – to make what we're trying to learn interesting and memorable.

Thus, a cognitive scientist is not surprised to learn that most of our technology-based interventions in education have been disappointing. That's because many (if not most) of the interventions run counter to what we already know about how our minds work. For example, if a student has not memorized the multiplication tables, she will struggle to do complex higher-order math problems, because she will burden her short-term memory with

the relatively simple task of basic multiplying. Similarly, if a student does not have a rich vocabulary or broad exposure to content in key subjects such as science, history, geography, music, or art, he will struggle to comprehend passages that involve those subjects – and Google won't help him. Most provocatively, if we mistakenly assume students are capable of self-directing their learning, we will deprive them of the critical guidance they need from educators to improve their understanding of important subject matter.

If we accept these lessons from cognitive science – no easy task, though there is ample research to support them – then we have a foundation around which to build an alternative vision of education in the digital age. Put simply, we should adopt policies and promote practices that use technology in ways that are harmonious with our understanding of how learning takes place, or will add to that understanding. Technology thus becomes not an end unto itself but rather a tool that facilitates the larger goal of transforming the education system in the same manner that most western societies transformed the medical profession over the past century – by using scientific insight and technological innovation to drive systemic transformation.

What might this look like in practice? For one, using well-designed computer games, we might develop ways to assess student learning in real time rather than through cumbersome, single-point-in-time summative assessments (and without students even knowing they are being assessed). For another, we might encourage peer-to-peer educator collaboration to design interesting lessons, curriculum and assessments and then track the performance the developed resources have on student learning. Indeed, the more data-rich we can make our education system at every level (from student to school to state), the more we might harness the power of data analytics to provide insights into what practices are *truly* innovative – not simply new or different, but better.

This alternative vision contains three other compelling features. First, because the system will be oriented around scientific principles, new policies and practices that prove effective will be generally applicable, and therefore capable of scaling across the system. Second, this approach offers a limiting principle: if a policy or practice using technology contradicts what we know about how the mind works, we shouldn't pursue it. (This limiting principle helps explain why the history of education technology is replete with grandiose promises that went unfulfilled.) Finally, the alternative vision puts student learning as directed by effective educators at its centre, with technology serving as an enabling agent in support. This is not about replacing teachers with computers, or books with iPads. It's about empowering our understanding of what real learning looks like.

To my knowledge, no other nation has fully embraced this alternative vision of blending cognitive science and digital innovation to drive systemic transformation of the education profession. John Hattie's work is probably the most visible example of the academic research underway to support this type of effort. Likewise, education secretary Michael Gove has started to make more frequent reference to cognitive science in support of UK education policy (though whether the science supports his specific recommendations is less obvious.) And in the US, Dan Willingham's forthcoming book (provisionally titled *Teaching in the Age*

of Distraction) should contain a wealth of new thoughts about the benefits – and costs – of technology in education.

But international leadership on this issue is lacking. There is an opportunity for some nation to step in, embrace the science of learning, and harness the potential of technology to expand our understanding and knowledge base. The nation that does that will likely find its efforts rewarded with improved student achievement results across virtually any measure – and perhaps even a new definition of student achievement itself.

APPENDIX 2

The impact of scientific decisions

Moana was in her fifth year of teaching Year 4 to 6 students at a decile 3 suburban primary school, with a class comprised of 40% Maori and 58% Pasifika children.

Like many teachers, Moana firmly believed students have specific "learning styles" and that her students were "kinaesthetic learners" who needed practical activities to understand maths. But there is strong evidence from the scientific community that this approach doesn't work.

Rather than tell her she was wrong, however, a researcher worked with Moana to develop a classroom–wide collaborative inquiry approach to teach students mathematical argumentation. Under this method, students are taught to understand maths through examining the premise of different results and justify (or argue) which outcome is correct. In other words, students take a scientific approach to learning mathematics.

Although she was initially reluctant, Moana gradually came to understand "the power of who asks what" in the classroom, largely through examining videotapes of her lessons and identifying key learning moments. In her words, "it's good to see good thinking coming through, blows me away because before they never had a chance to explore."

Before, Moana used a "learning styles" approach at odds with scientific evidence. **After**, she shifted to cooperative-learning strategy to create a community of young mathematicians.

Percentage of Students

	Significantly lower	One level below	At average age-group level	Above average
Before	31	59	10	0
After	0	0	61	39

Achievement level relative to the average for this age group (NumPa)
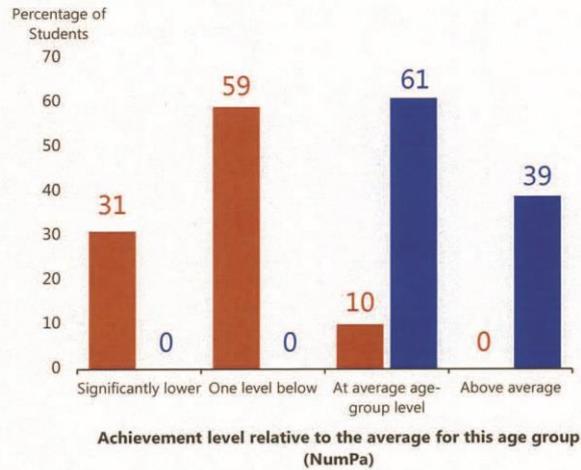
"Don't dis her man, when she is taking a risk."

Wiremu, a 10-year old boy, instructing another student to respect one of their female classmates as she worked out a maths problem in front of the class.