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The world's best-performing education systems

What would it take for them to adapt to what might be a very different future?

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CSE CENTRE FOR STRATEGIC EDUCATION
Leading educational thinking and practice

Contents

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Introduction

For much of my professional life, I have studied the education systems of countries that have, year after year, dominated the world's league tables for student performance. The list of countries whose students outperform American students by ever-wider margins has been growing for many years. Whether in sport or business, if one is falling further and further behind the leaders, studying how they have managed to outdistance you is a time-honoured and very effective way to get better.

That approach makes sense if you think that the future will be much like the past, but suppose that is not the case. If the future is very different from the past, the strategies that worked in the past may no longer work and the future will belong, as it always does, to the newcomers who build a different kind of system that is better adapted to the demands of a greatly changed world. So, it is my hope that what follows is of interest both to the countries that now do the best job of educating their young people, as well as those who hope to join their ranks.

If the future is very different from the past, the strategies that worked in the past may no longer work and the future will belong, as it always does, to the newcomers who build a different kind of system that is better adapted to the demands of a greatly changed world.

In this paper, I consider the kinds of changes now taking place that appear to me to have the most important implications for the design of national education systems. Humanity faces unprecedented threats to its continued existence on this planet – from another pandemic far worse than COVID to environmental catastrophe to nuclear war – at the same time that emerging technologies hold the promise of broadly shared prosperity and a better life for billions of people. As advancing technology takes the jobs of those with just the 'basic skills', the anger and frustration of those left behind could sever the political bonds that hold our societies together, making it impossible to survive the transition now under way. However, if our governments can find a way to provide the kind and quality of education heretofore provided only to our élites to virtually everyone, humankind could have a very bright future.

Central to this analysis is for education to be seen not just as a response to a changing world but as a major force shaping the changing world. Failure to educate larger and larger proportions of national populations for the intellectually and socially demanding work ahead will, without question, destabilise our economies and then our democracies, and make effective adaptation impossible, with grievous consequences.

In this paper I consider a variety of strategies that nations could use to greatly improve education outcomes at a cost that countries could afford, and explore the possibilities and pitfalls of the politics of implementing those strategies.

This is not a treatise. It is the sketch of a treatise, an attempt to lay out a framework for a debate that is overdue and urgently needed. If it succeeds in stimulating the beginning of that debate, it will have served its purpose.

On the future

Some competent analysts see us careening into a future in which advancing climate change could bring an end to human life on earth, or perhaps a dystopian future for humans in which we turn into pets for intelligent machines. Others forecast for humans a better quality of life than anyone has ever imagined possible, on a grand scale. The question is how education can bias the outcome away from the former and toward the latter.

The two biggest destabilising forces for the world's leading industrial democracies appear to be globalisation and advancing digital technologies which, together, are devastating the job market for people with relatively low education and skill levels in those countries. Increasing surpluses of such people are driving down their wages and standard of living. Increasing shortages of people with the complex skills and abilities that are now in great demand are sending their compensation through the roof. Increasing flows of people from countries with collapsing economies, into the more advanced economies, only compound the anxiety, fear and resentment of those who have been left behind in the advanced industrial economies. This leaves them ripe for the work of demagogues seeking power, which is a growing threat to democratic forms of government everywhere.

The first question is whether education is a driver or a mitigator of these forces. We like to think of education as the great equaliser but, in many of these countries, highly skilled and well-connected people are busy hoarding the best preschools, schools, colleges and universities for themselves. There is a big literature on the way higher education institutions operate to favour the rich and keep out the poor. It is easy to make a case that our mass education systems – set up in the name of social mobility but designed as a vast sorting system – are now increasingly functioning in many countries to sort as many as half of our students into a future of poverty, anxiety and loss.

The core problems are that the less-well-educated in the rich countries are competing with equally well-educated or better-educated people in other countries, who can live very well in their home countries on much lower salaries; and are also competing with machines that cost less and less and can do more and more with each passing year. While the less-educated are losing the race against the machines, the better-educated workers are using the machines to become ever more productive, pulling further and further ahead of the less well-educated.

Some economists say not to worry – there have always been fears of widespread job loss with technological advances, but we have always emerged with more and better jobs, as well as broadly increased prosperity. Others, who I think are right, say this time is different because of our global interconnectedness and the extremely rapid pace of technological change.

That sets up a race between education on the one hand and technology and globalisation on the other. Looked at in this way, the education policy makers should not be sitting around waiting for the economic analysts to predict what skills will be needed in what quantity.

The arrow could just as easily run in the other direction. Instead, the skills that are produced could determine the course of the economy. If we produce many more people with the right kind of high skills and broad knowledge, their wages will stop rising so fast. If more of the people who now have low skills become much more skilled, there will be fewer people with low skills in the workforce, the surplus of low-skilled people will go down and their wages will go up. Income inequality will decline.

Humans, unlike the machines, need a life that is fulfilling, has meaning, makes them feel that they have a life that is worth living.

Broadly shared prosperity will not come with income redistribution. Broadly shared prosperity will prevail only when everyone has the education and training needed to contribute in an important way to a thriving economy. When that happens, social cohesion will increase rather than decline and democracy will prevail. That is the case for education as the driver of the outcomes we want.

However, it does not look good for our side. The cost per student is rising steeply across the OECD countries, but outcomes are flat or declining. The forces preventing important changes in the system of education provision appear to be much stronger than the forces of change and adaptation.

There are other issues. If most of the jobs requiring relatively little education disappear, and the education system succeeds in educating most students to a much higher standard, can the economy absorb them? If not, does that matter? Will we be producing more and more people for a life of leisure, who will not need jobs? What kind of society emerges from that picture? How does one educate for a life of leisure?

Maybe, on the other hand, the sorting system got the sort right and it turns out that the reason it is costing us more and more to educate our kids, but they do not learn more, is that they cannot. Have we reached the natural limit of what the population can learn? I do not believe that, but some smart analysts do.

What I have just said is the result of my analysis of the effects of globalisation and advancing technology on the labour market, social cohesion and our fragile democracies. There are other things to consider, however. Humans, unlike the machines, need a life that is fulfilling, has meaning, makes them feel that they have a life that is worth living. Organised religion, respect from one's family and community, a shared set of rules within which one lives, a feeling that one lives among others who share the same values where one can feel at home – all were provided in greater measure in the past than they are now. All are now in decline or under assault. Even as our environment is creating conditions that demand more empathy with others all over the world and greater cooperation at every level, the forces at work are isolating more of us from one another in fear and suspicion, and creating echo chambers for views of others and of our surround that are less and less grounded in fact.

There is also the issue of demographics. For a long time, demographers were focused on Malthus' prediction that population growth would outrun our capacity to feed everyone and humanity would eventually perish. The modern version of that prediction flowed from the observation that inexorable growth in the global populations was combining with increasing wealth. Everyone who is poor aspires to the standard of living enjoyed by the wealthy. The result is enormous, ever-increasing stress on the planet, the result not of poverty but, ironically, of economic success. It is also true that formerly poor farmers, who relied on their children for their labour, have far fewer children as their incomes grow and they

move to the city, where their children are a cost rather than an economic benefit. Demographers have been forecasting peak global population about 20 or 30 years out and then a gradual decline. The pandemic will send hundreds of millions back into poverty, but the upward march should resume eventually.

That, of course, would be a relief, but the demographers are not relaxing. As temperatures rise around the world, crops are failing on a colossal scale, wildfires are out of control and rising waters are forcing large populations from the low-lying littorals where much of the world's population has congregated. The result is likely to be ever-greater waves of migration that threaten the political stability of otherwise successful highly industrialised countries.

We need to make the profound changes in our education systems that will be needed to cope with the threats and take advantage of the opportunities.

None of these challenges is necessarily fatal. In fact, it is entirely possible that we can succeed in creating a world of unprecedented psychic and material bounty. It is worth taking a moment, though, to consider what that might mean as we think about the goals of education. I am no fan of 'wellbeing' as the main aim of education. That framing of the goal implies to me a Whig theory of history: that history is an inevitable march toward progress; that our other needs have been met; and that this state of individual wellbeing is all that remains to be achieved, for everyone.

I do not see our current situation or our future in that way at all. I think that humans now face unprecedented threats as well as unprecedented opportunities. We need to make the profound changes in our education systems that will be needed to cope with the threats and take advantage of the opportunities.

The other problem with posing wellbeing as the ultimate aim of education is that it comes across as a goal solely for individuals.

Aristotle is often cited as the first and most important philosopher to set this goal not just for education but for humans living their lives. However, Aristotle assumed fellow Greeks understood that personal wellbeing depends on the degree to which everyone in the community works together on behalf of the whole group, in a display of what the Romans call 'virtue'. It was obvious to him that individuals could not experience wellbeing unless there was a pervasive moral order – a culture of virtue – that prevented some individuals and groups from flourishing at the expense of others. He thought it would be equally obvious to his readers.

Many of Aristotle's successors pointed out that history showed over and over again that humans, given the chance, more often than not pursued their own self-interest at the expense of others. Democratic forms of government are all experiments in forms of government that acknowledge this truth, which do not rely on virtue to prevail in human affairs, but which still allow the people to resolve their differences and work together to build a better life.

In my view, the future I have described is a future that will test the ability of democracy to deliver more than ever before, and educators will have to consider what it will take to preserve our democracies, with a laser focus. The events of the last few years have made it plain how fragile our democracies are and how important it will be to make sure that our citizens understand why democracy is so important, and what it takes to keep it alive, and also to have an understanding of the issues humanity now faces that is as deep and wide as the issues themselves.

My aims for education now would be to enable humanity to address successfully the existential threats we now face; to take full advantage of the unprecedented opportunities now within our grasp; and, in the service of both of these aims, to fully embrace the values, perspective and lessons of the Enlightenment and the commitments of Humanism – including and especially the core principles that underlie our democratic form of government. In the current environment, these goals cannot be accomplished without very high levels of education and technical skill. Nor can they be accomplished without a full embrace of the idea that we are all in this together. Individual fulfilment needs to be balanced by the common good. That way lies wellbeing for all.

On curriculum

There is broad agreement on the wide range of outcomes for students now deemed valuable by educators. They include deep understanding of the conceptual structure and structure of knowledge in the core disciplines; the ability to draw on that deep understanding of multiple disciplines to analyse the enormous challenges society now faces; the ability to interweave the study of theory and concepts with the constant application of theory to real-world problems great and small; the capacity to think creatively and to draw on what one has learned to innovate effectively; the ability to develop the social and emotional attributes that will enable students to function effectively in relation to others; as they work together in constantly shifting settings; and the ability to monitor and control their own mental functioning in productive ways.

Add in the ability to quickly and easily learn new things of all kinds and the specialised technical skills needed to leave school with the skills employers offering good jobs are looking for; the need to understand and develop empathy for others near and far who might be very different from them; to develop values and ethics that will enable them to distinguish right from wrong and do what is right when no one is looking; and to learn how to take care of their physical health. Also, finally, add in a sophisticated grasp of the conditions under which democracy can flourish and be maintained, as well as the fragility of democracy and the ease with which it can be extinguished.

This, in effect, is the agenda that many of the world's most important international bodies have urged the world's nations, provinces and states to require their teachers to teach. One prominent source of ideas as to what the goals of the new, greatly enhanced curriculum ought to be, a source endorsed by senior figures in bodies ranging from UNESCO to OECD, is the widely-cited work of the Center for Curriculum Redesign in the United States. The Center's principal publication, *Four-Dimensional Education: The Competencies Learners Need to Succeed* (2015), catalogues the demands of the new curriculum in over a hundred pages.

However, it leaves only three pages for the topic of how to implement the curriculum it lays out, two of which are devoted to the use of technology to deliver the curriculum. The authors contend that they have done the hard part by laying out the right curriculum framework, leaving implementation of the framework to the professional teachers.

Internationally, many policy makers have taken them at their word and developed policies and directions to their teachers accordingly. However, many teachers have told our research teams they do not know how to do it in practice.

They are, they say, being asked to teach the core subjects in the curriculum that they used to be asked to teach, but to teach them for deep understanding and conceptual mastery, which will take more time. They are being asked to teach, in addition to the core subjects, a list of interdisciplinary subjects, which will take more time. They are being asked not just to teach these disciplines and interdisciplinary subjects for understanding, but to interleave their teaching of the theory with a lot of project-based and problem-based learning that will enable their students to apply what they are learning to a wide variety of real-world problems, which will also take more time.

Most of what has just been described is cognitive work for students, but that is only part of what they are now being asked to do in class. They are also being asked to produce many forms of non-cognitive learning to help students acquire a wide range of interpersonal skills, which again will take more time. The list of these skills is very long.

When teachers ask many of their ministries how they are supposed to do all this with no more time in the day than they had before, they are told that the ministry makes policy but it is up to the teachers, as professionals, to figure out how to get it done.

In my opinion, the teachers are right. Coming up with the framework is the easy part. Figuring out how to make it work in classrooms with real students is the hard part. Teachers need a lot of help. In many countries, they are not getting it. They are in many cases resolving these issues by doing everything they are being asked to do, but doing it at a very superficial level or simply doing what they feel most comfortable doing, and ignoring the rest. That response could easily produce an education less effective and less equitable than the more traditional education it replaces. This is a key issue for the future.

It is not just a matter of figuring out how to find the time when there is no more time. The challenge goes way beyond that.

I do not see a new curriculum here. All over the world, over the last half century, schools serving the world's élite families and their children have been aggressively pursuing this agenda with considerable success. The students who have been exposed to that curriculum have a straight shot at getting into the finest universities in the world and using them and the networks that come with them as launching pads to their positions as the new masters of the universe.

What is truly new is the demand that all or nearly all students experience a curriculum similar to the one offered to our élite students in our élite schools. That would be a massive change. The sorting model produced a pyramid of opportunity, at the top of which we offered our best and most advantaged students our best teachers; our best facilities; a demanding curriculum; the enormous advantage of being surrounded by other highly advantaged, ambitious, self-confident students who place a high value on academic accomplishment; a rich cultural environment and a world in which well-placed adults would support them every step of the way.

It is by definition impossible to extend this big bag of advantages to all students. The question is how to produce outcomes comparable to the outcomes that élite students now achieve without the enormous advantages that élite students enjoy.

Money is not the answer. OECD statistics show that, after a bare minium now exceeded in all advanced industrial countries, there is hardly any correlation between amounts of money spent and levels of student achievement. What really matters is how the money is spent. You cannot pour more financial resources into the current system to get the results we now need. The system has to be changed.

Just giving our teachers, in effect, a copy of *Four-Dimensional Learning* and telling them to work with their peers to figure out how to teach for the outcomes described in that book, is not the answer either.

The question is how teachers of students who do not come to school with the advantages that students in most élite schools come to school with, can nonetheless bring these less advantaged and more advantaged students to comparable standards, with no more time and no more money than now.

Systems that have made good progress on this agenda – Estonia, Hong Kong and Singapore are good examples – started on their work decades ago. They have built on curriculum which has more often than not been in place for a long time, which emphasises not the accumulation of facts and rehearsed procedures, but rather a deep understanding of core concepts and the structure of knowledge. In addition, they have worked hard to make sure that their teachers have themselves had a first-rate education, an education that corresponds closely to the aims of the new curriculum agenda. They have proceeded very slowly and steadily, step by step. They say they are not by any means finished. These countries are leaders in the production of highly educated and very well-trained teachers. They have very coherent, well-aligned learning systems and have been leaders in incorporating the findings of neuroscience and cognitive science into the design of their learning systems. These are all key supports for a highly effective curriculum. I believe it is very risky to mandate significant curriculum change, of the kind I mentioned above, without first putting such supports in place.

These systems, the ones making the most progress on providing an élite curriculum for the vast majority of their students, have realised that providing a much more demanding curriculum is very dangerous if it is not delivered by teachers who themselves have been educated to the standards now demanded of the students; if those teachers have not been taught the techniques required to get students from every conceivable starting point to the more demanding standards; if the school is not organised to deliver the help that those students need before school, after school, on the weekends and during the summer, to get there; if school finance is not changed to reflect a realistic assessment of the different needs of different students all of whom are expected to get to achieve at a high standard; if the qualifications system and the pathways students take to get their qualifications are not changed to reflect the new goals and provide the right incentives for students to achieve them.

I will deal with several of these issues below. The point here is that many countries seem to me to be persuaded that, just by issuing a different set of curriculum guidelines to teachers and giving teachers much more discretion in how they implement those guidelines, they will get greatly improved student achievement.

I observe that many of the countries that appear to be going down this path are among those in which PISA scores are declining most steeply. It would be foolish to say that their curriculum policies caused that decline. Famously, correlation does not prove cause. However, it is at least possible that there is a causal relationship here.

The data that shows that, among OECD countries, the costs of schooling are steadily rising, but student performance is not, suggests to me that

1. it is important to very closely observe the handful of countries where scores are rising, to see if my hunch is right, and their systematic, patient and cautious approach to the new curriculum agenda accounts at least in part for their success; and
2. it is also important to look at the countries in which costs are rising but student performance is steady or falling, and look to see if it might be in part because they have aggressively pursued the new curriculum agenda without first putting in place the full range of supports that are described in this report; supports that can be found in the countries in which performance is continuing to improve.

We should be redesigning our education and training systems as continuous learning systems, rather than conceiving of school and university as providing all or most of the formal education and training a person will need.

While it is important to focus on the consensus 'new curriculum', there are other curriculum issues that are no less important. For example, a large and growing fraction of young people are winding up in occupations they did not train for in school and university. What are we to make of that? Some people conclude from this that there is no need to train young people for particular occupations. What is important is to provide a strong liberal arts education, with close attention to non-cognitive factors that will enable everyone to roll with the punches and learn any specialty they need to know, quickly and frequently.

However, the attachments between employers and employees are fraying fast. Employers will be very reluctant to invest in employees who work part-time, as gig employees or even full-time for that employer if the employee is highly likely to leave for more pay at another firm that does not invest in their employees in that way. So, employers want their new hires to come to them not just with the benefits of a good general education, but with the specific technical skills that employer needs. Further, cognitive scientists tell us that that there is no such thing as learning to learn. A lot of learning is specific to the task, occupation or cognitive domain and has to be learned again for another one. Finally, the same cognitive scientists tell us that it takes many years and a lot of deliberately gained experience to become expert in any given area.

So, what should educators do? Should we spend the school years educating broadly and deeply, to provide a strong foundation for life and for mastering the technical skills needed for multiple careers later? Or should we be starting early to help students identify areas in which they want to develop real expertise, and provide them with the support they will need to succeed in that? Or should we try to do both? Or should we let students and their parents choose which of these paths to follow?

We should be redesigning our education and training systems as continuous learning systems, rather than conceiving of school and university as providing all or most of the formal education and training a person will need. How should the questions I just asked be answered, if that is the direction we will take in the future?

Vocational education is key, to my mind. In some countries, 30 to 50 per cent of the cohort is in this stream. These are the young people most likely to face a dismal future as globalisation and automation gather speed. Parents in many, if not most, advanced industrial countries think of VET as a dumping ground for young people who are thought to be incapable of serious academic work. The message has gone out that the good jobs in the future will be jobs for people with at least a bachelor degree.

There is no evidence, however, that more education is actually adding much value to the knowledge and skill that most students have when they emerge from formal education. No economy can function without a strong segment of the workforce with middle skills. We seem to be on a path now to produce fewer and fewer people with the middle skills we will need, and too many with tertiary degrees that employers value less and less.

Singapore and Switzerland, and possibly Denmark, show us another path. I believe we are, or ought to be, headed toward a future in which VET morphs into a more applied form of education, intended to produce strong technical skills, but requiring strong academic skills and knowledge and academic pathways that involve much more applied work. In this scenario, VET is no longer an education of last resort, and the stereotype of those in the academic track as having no idea how to negotiate the real world becomes obsolete.

In this image of the future, the boundary between VET and academic preparation becomes increasingly fuzzy. In the end, most students will need both a very strong liberal arts education for a foundation and very strong technical training in a particular arena, to give them access to a labour market in which employers will expect them to have strong technical skills in their chosen first career right out of school. A revitalised VET is likely to be the backbone of continuous adult education. Experts in that field are likely to find their expertise suddenly in demand, from academic educators eager to find out how to integrate high-quality applied education into their academic programs.

On teachers and teaching

Most of the literature on teacher quality focuses on teacher education, but that is a case of misdirection. Most teacher education that takes place in schools of education is not teacher education. It is teacher training. My experience leads me to believe that the quality of the education teachers get in the subjects they will teach is – at least for now – the threshold determining the quality of instruction their students will get when they become teachers, even in the primary schools. A teacher who has a deep understanding of how mathematics works will simply ignore a set of state standards that were put together by a committee of teachers – each of whom logrolls her/his own idea of what is important to teach, into an incoherent statement of state curriculum standards for mathematics – and will teach her/his students about the structure of mathematical thinking in a very powerful way.

> any country ... must make sure that it staffs its schools with teachers who really know their subject.

The primary teacher who did not like mathematics in school, took in as little of it as possible and absorbed only the procedures required to get standard results, but has no idea of why they work, will pass all of that along to her/his students, whatever the state curriculum is. No state curriculum will turn that teacher into a good teacher of mathematics, no matter what it says. In addition, no state curriculum, no matter how poorly written, will turn the teacher of mathematics who has a deep understanding of the subject into a bad teacher of mathematics.

So, any country that wants a faculty capable of reaching the goals spelled out above must make sure that it staffs its schools with teachers who really know their subject. It turns out that there is a trick to that. The trick, pioneered as far as I know by Finland more than two decades ago, is to limit the right to offer professional teacher education to a handful of research universities. By doing that the state restricts the pool of candidates for teaching positions to people who qualify for admission to research universities, a high standard that is largely based on how well-prepared the applicant is in the core subjects in the curriculum. Almost all of the top-performing countries on PISA have done this, with many variations on the theme. Low-achieving students do not bother to apply. Good students who would not have been caught dead applying to a school of education before such policies were implemented are now attracted to the field, because getting in is a sign of accomplishment, not of failure.

In two well-known reports on the 'world's best school systems' McKinsey and Company highlighted the importance of the quality of the education that teachers have. However, they seriously understated the case when, in the second report, they said that the top performers got their teachers from the top third of high school graduating classes. The crucial issue for countries that are serious about addressing the challenges described above is how to get a teaching force that is as well-educated as the teachers in the countries with the best-educated teachers. The top

third of teachers in Singapore are much better educated than the top third of teachers in the United States. Teaching forces reproduce themselves, generation after generation. Countries that aim higher for their students will have to figure out how to break the cycle. Limiting the right to offer teacher education to people who can get into research universities is a very important strategy for countries that are not now doing that. However, a poor-performing country that succeeds in getting its teachers from the top third of its high school graduates should be aware that it has not matched the intake of a country that also recruits from the top third, if that country's high school students are not strong performers on PISA.

High-quality teaching, of course, depends on more than a deep knowledge of the subject one is teaching. After all, as they say, you are teaching people, not subjects. Teaching is a craft. The best way to learn a craft is by apprenticing to a master, under specified conditions designed to ensure constant feedback from the master, on a carefully sequenced series of progressively challenging assignments which, if successfully accomplished, signal that all requisite skills and knowledge have been acquired. If the craft itself is informed by science, then the science must inform the way in which the craft is taught. On all these points, see the next two sections.

On careers in teaching, the teaching profession and school organisation

What will teaching look like in the future? In all high-status professions, one's membership in the profession is a function of the training one has had. A doctor is a doctor, whether the individual is a practising physician, a researcher, a professor in a medical school, a hospital director or a senior government official in charge of approving new vaccines. Blue-collar workers, in contrast, are blue-collar workers by virtue of the job they hold. When they assume management responsibility or any significant leadership role, they are part of management and no longer 'workers'. In a law firm, or engineering management firm or a research laboratory, there is no bright line between worker and management. In many professional service firms, many of the workers are also managers and sometimes owners. Having a career in the law, medicine, engineering, accounting and engineering means starting out with modest responsibility, status and compensation, and acquiring more of each of these things as one gains expertise. Most teachers have the same job at the end of their career as they did when they began. Teaching has many of the attributes of blue-collar work.

Shanghai and Singapore have pioneered an approach to teaching that is squarely modelled on the best modern practices of professional work organisation, management and career development in private industry, professional service firms and the military. Teachers spend less time teaching and more time working in teams to improve systematically every aspect of school operations, provide individual assistance to students who are starting to fall behind – coordinating with allied agencies, working with parents, creating highly effective lessons, researching new initiatives and carefully evaluating the initiatives that are underway, to determine whether they are producing the desired results.

Teachers have real careers in this system. As they get better and better at the work, they get more responsibility, authority, status and compensation; another mark, as just noted, of a true profession. Professor master teachers in Shanghai become full professors in collaborating universities, while serving as master teachers in their schools, and get their research papers on their action research published in refereed university journals.

What I have just described is a very disciplined machine for the continuous improvement of schools. Just as in the best professional service firms, one cannot rise up the ladder without extensive sharing of one's growing expertise with others. The talent-management system is designed to identify people with strong potential early, and invest heavily in their development. The whole system is designed to identify, develop and reward talent systematically, and to use the most talented to drive the whole organisation. This is the antithesis of the egg-crate school, with all teachers doing the same job, alone in their classrooms.

Is this the future? Imagine now that we are here talking not about just primary and secondary schools, but some very different form of universities, as well as for-profit and not-for-profit educational institutions, and education and training units in major corporations … a wide variety of educating and training organisations. I will wager that the most successful ones will lead the way toward forms of organisation, management and work organisation that look like what I just described. If that happens, teaching is likely to become a much more attractive career to the best and brightest, because they will know that those who work very hard at their vocation, and who excel in it, will be recognised and rewarded. Educational institutions of all kinds will be far more effective.

The prior question, though, is whether the core government-provided public education will lead the way in these developments or will follow, reluctantly, as parents and students slowly turn to more dynamic institutions on the periphery.

On institutional capacity

If the first question is what the future holds, then the second question is whether our education institutions are up to the challenge, whether they have the capacity required to pull off a vast improvement in outcomes with little increase in cost. In my mind, there are two big worries here: the capacity of the schools of education and the capacity of the ministries. The two together comprise all the main elements of the system needed to continuously improve the quality and effectiveness of the system.

The schools of education have three important functions, which are

1. preparing the future education workforce;
2. providing most of the research used by practitioners and policy makers to improve outcomes for the system and the students; and
3. providing technical assistance to policy makers and practitioners.

If the first question is what the future holds, then the second question is whether our education institutions are up to the challenge, whether they have the capacity required to pull off a vast improvement in outcomes with little increase in cost.

In my view, most schools of education in most countries are not doing any of these things very well, and any country that aspires to meet the challenges described above will have to figure out how to change that.

I recently viewed an address by Dirk Van Damme, now retired, formerly the head of the Innovation and Measuring Progress Division of the OECD's Education Directorate, in which he neatly summed up a view we share of the current state of education research. In it, he noted that much of the research on education is driven by ideological commitments, rather than a true spirit of inquiry. Many of the best known and most cited research findings have been shown to be false repeatedly and decisively by competent authorities. Very few of the experimental findings have been verified by anyone. There is no correlation between national expenditures on research and student performance. The most important research on learning has for decades been by individuals and research laboratories outside education schools, not in them. Even though the schools of education in the top-performing countries are now mostly in their research universities, they are typically among the lowest status institutions in those universities.

The disciplinary education that prospective teachers get in the core subjects in the school curriculum are typically offered not by the school of education, but in the schools of arts and sciences. They are often introductory courses that are taught as the foundation for more advanced study and are not designed to teach prospective teachers the substance that would be most useful to them as future teachers of school-age students. The education school typically has no control over the design of those courses, because these courses are offered by another part of the university. As a result, it is very difficult for the education school faculty to teach future teachers how to teach the specific subjects they are expected to teach, which leaves them to teach how to teach in the abstract, without regard to the subject being taught, although

it is well known that the most effective pedagogy is pedagogy that is specific to the subject being taught.

Though teaching is a craft, the tenured faculty hired by the typical school of education is recruited, hired and promoted on the basis of the usual academic qualifications, meaning their research and publication record, rather than on the basis of a demonstration of their skill as a teacher or their demonstrated skill in passing on their craft to apprentices to the trade. Thus, we have a craft that does not put master craftspeople in place to train the next generation of crafts people. So, the prospective teachers are not informed by masters of the craft nor are they prepared by people steeped in sound research that could guide their practice.

While there is a mountain of research on the schools, there is very little on the organisation, management and leadership of national education systems. This is odd.

Nonetheless, the graduate schools of education in our major universities are a primary source of both policy analysis, to guide policy makers, and of technical assistance to guide practitioners. Policy makers are perennially frustrated by getting policy advice that is insensitive to the opportunities and constraints they face, and practitioners often find that the technical assistance they get is based more on ideology than on valid research findings.

There are exceptions to every one of these statements. Though they are rare, they are important, because they contain clues to what needs to be done if these vital institutions are to play the role they must play if the system is to rise to the occasion.

There is another institution or concatenation of institutions that will be a vital element in rebuilding our mass education systems to meet the future successfully. That is, broadly speaking, government. The public romance has it that the only really important players are the schools, teachers and students, but the reality is very different. Some mass education systems perform far better than others. That is because they are better-led, better-organised and better-managed than others – all functions that are played out far from the schools attended by students.

The most competent ministries of education are better at sensing where the world is going and how their system must change to meet it successfully; better at getting broad public ownership of the new direction they have set; better at finding, attracting and preparing the education work force than others; better at getting money to the students who need it; better at coordinating with all the allied services that students need to be successful; better at creating incentives for students to work harder and teachers to improve their practice; better at keeping up with the policies and practices of the top performers and adapting what they learn for use in their own country; better at gaining the support of the public and opinion makers; and much, much more.

These are large, complex, multifaceted systems. The way in which they are led, organised and managed makes an enormous difference. While there is a mountain of research on the schools, there is very little on the organisation, management and leadership of national education systems. This is odd. Leaders of major corporations are lionised in the business literature, and their strategies and practices are studied as carefully in business schools as chess moves in chess clubs. The same is true of studies of national political systems. No one would study political systems as if the only politics that mattered is local politics. No one would study business as if the only unit that mattered is the retail store or the manufacturing floor.

I believe that this is a very serious issue as we think about an agenda for coping with the future, because the institutional capacity for leadership in our national governance and management systems in education has been sorely compromised in many countries. That is because of a grave misunderstanding related to teacher professionalism. Decades ago, many countries – rightly persuaded that the future of their education system would depend on turning school teaching from an occupation organised on blue-collar worker organisation principles into a true profession – were then wrongly persuaded that teacher professionalism was synonymous with teacher autonomy and, further, that they could only grant teachers the necessary autonomy by greatly reducing the authority of the state. The state, it was said, should restrict its role to making broad policy, ceding to the teachers the right and responsibility to implement those policies as they saw fit.

In some countries, this ended up involving a careful sorting out of which kinds of decisions should be made at which level of the system, guided by an understanding that, for the system to function properly, many decisions had to be made far from the schools; many needed to be made by the school faculty as a whole; and many others needed to be made by individual professionals. These countries not only allocated decision-making authority in a rational way, but they also created the capacity at each level that was needed to properly support the lower levels.

no professional has the kind of autonomy that is now often claimed for teachers.

In other countries, however, many ministries just got much smaller and their remit was greatly reduced. Teachers were told that it was up to them, as individuals, to set the curriculum within exceedingly broad and vague guidelines; mandated student testing would be greatly reduced or eliminated; and students would be encouraged to chart their own paths through the curriculum.

Doctors certainly have the authority to decide on the course of treatment for their clients and patients, but they can be sued for malpractice, on the grounds that they have failed to follow the profession's accepted and validated practices. They can be ejected from their chosen profession for violating those practices. They compete with one another for the custom of their customers on the basis of their reputation in the community. They are not free to make it up as they go along.

I am not advocating similar rules for teachers. I do not think they are appropriate for teachers because the performance of a particular student is never the exclusive product of the actions of one teacher and none of these 'customers' can be allowed to fail. It is important, though, to recognise that no professional has the kind of autonomy that is now often claimed for teachers. However, because some countries at some point measured the degree to which their teachers were professional, by the degree to which teachers were trusted to do whatever they wished, some of those countries may no longer have ministries with enough authority or capacity to chart a new course for their country and marshal the resources needed to pursue that course.

This is not to say that ministries need to be top-down and dictatorial, any more than modern, well-managed, dynamic companies should be top-down and dictatorial. There are very different models available for managing national education systems that work very well.

I think about the issue of the schools of education and the issue of the capacity of national education ministries as one issue: the issue is the capacity of the system for self-renewal, for adaption to a swiftly

changing environment, for effective system design and effective system operation. Many important institutions have elaborated, sophisticated, complex, formal systems for intelligence gathering, benchmarking, research, development, innovation, monitoring, course correction, and so on. Many of these functions are not so well-developed in our public education systems.

The remit of government in education at the national level is changing. Nations now have to develop highly-integrated, very sophisticated systems to support lifelong learning – of every kind, in every venue, for people of every age. All these systems will have to be reconceived and rebuilt to work flexibly, yet seamlessly. Many ministries will have to learn how to work closely together, within a common framework, on agreed goals, within agreed constraints. They will have to be highly capable and very resilient. Much depends on whether or not nations succeed in building highly competent agencies that will be able to earn the trust of people in many countries who no longer believe their government cares about them or will deliver for them.

On the vision

We will have to not only recognise but embrace the fact that education and training takes place all the time in many places and in many guises, outside as well as inside institutions organised for learning – and the world will be awash in all sorts of information about all manner of things, about how it works, why it works, how to do it, the history of it and on and on. Many professionals prefer a vision of the future that harks back to Rousseau. It is a very attractive vision of a world in which children and adults learn because it comes naturally, the product of a vital and very human curiosity that needs only to be unleashed. In this world, teachers do not need to teach. They need to get out of the way, to gently guide, to catch the falling and set them back on a path of their own choosing, free from the constraints of the rules now in place, and free too, from the fear of failure, fuelled, for adults, only by that person's intellectual passions and occupational interests.

We do not need a new pedagogy. We need to adapt old pedagogies for modern times.

I believe learning is hard work, requires discipline and, for all but the brilliant autodidact, is very hard to succeed in without a lot of help, a lot of structure and constant feedback from a very knowledgeable and skilled teacher who cares about you as a person – an education that is most efficiently done in a social setting designed for the purpose.

We do not need a new pedagogy. We need to adapt old pedagogies for modern times. The most effective teaching ever done was modelled by Aristotle when he was hired by Philip II of Macedon to tutor his son, the future Alexander the Great, and by the artisan masters of Mediaeval Europe as they trained their apprentices. Both models are well matched to the findings of modern cognitive science. The instruction was pitched to the individual's level: challenging but not

so challenging as to be discouraging; assignments were organised in a sequence that presented similar intellectual and practical challenges at ever more complex levels; a lot of practice was expected with constant, detailed feedback; theory was constantly mixed with opportunities to apply the theory to real-world problems; a student's misunderstandings were quickly discovered and corrected; the form of instruction encouraged students to see the patterns as they learned so they would not have to figure it out again every time they did it; they would chunk up their knowledge for easy and quick retrieval, see the similarities among what on the surface were very different presenting problems, so that they could transfer what they had learned in one arena to another; and, finally, they could take the frameworks they had learned to understand in one part of the world and use them to gain a new and more creative perspective on another part of the world. We abandoned those pedagogies not because they did not work but because they were vastly too expensive to power mass education systems, and because there were very few teachers with the knowledge and skill to match the ability of Aristotle and the old meisters.

It will be very important to develop new forms of qualifications systems to drive the new model education system.

I believe that we are now in a position to reconstruct the world of Aristotle and the meisters and gain the benefits of the pedagogical models they originated, on a mass scale, using the vastly greater number of highly skilled teachers we can now muster, in combination with highly capable purpose-built digital platforms equipped to provide very powerful virtual environments for learning. This is not the place for a full description of what that would look like, but that may be enough to convey some sense of what I have in mind.

It will be very important to develop new forms of qualifications systems to drive the new model education system. I am wary, however, of some of the features of such systems that many people now advocate, particularly the accumulation of microcredentials attesting to the acquisition of little bundles of skills as if they were baseball cards.

I have no doctorate in a field in which everyone who works at my level is expected to have a doctorate, and my master's degree is in a field I have never worked in. My bachelor's degree is in philosophy and literature, two fields that young people are now advised to avoid like the plague. I have been totally unqualified for every job I have ever held and was the first incumbent in all of the professional positions I held save one. If I had lived in today's world, a world in which the first reading of a job applicant's application is done by a computer looking for lists of competencies and credentials, I would be a penniless homeless person, a ward of the state.

A person is not a pile of competencies as testing professionals define competencies. Some of the most desirable employers in the world have given up on the standard credentials that schools and universites offer and have invented new screening procedures that filter for the qualities they are really looking for. To the extent that they look at standard education credentials, they are just used as threshold conditions that have to be met for any consideration at all. To get the job, the candidate must have qualities of mind and character that are not described at all in standard qualifications and credentials. One of the greatest challenges in developing the kind of open, fluid, ever-changing system of continuous lifelong education is inventing very different ways to think about and measure the qualities most desired by the kinds of employers that will drive the next economy. We need a whole new way of thinking about qualifications and credentials.

Strategies for meeting the challenge

I began this paper by offering two paths to excellence for high-wage countries' education systems. The first was for countries to study intensively the education systems of the countries that now top the OECD PISA league tables and use what they learn to improve the operation of their systems. I pointed out, however, that this strategy assumes that the future will be more or less continuous with the past. That may turn out to be true.

However, if it is not, then the policies and practices that performed the best in the past may not do so in the future, in which case, very different strategies, strategies not yet thought of or perhaps only in their infancy, may be needed. This is particularly likely if it turns out that, in countries both rich and poor, second stage globalisation and second stage automation will greatly reduce the proportion of jobs that can be done with what we now call the 'basic skills.'

there is good reason to believe that most high-income countries could substantially improve their education outcomes by carefully studying the systems of the current top performers, and redesigning their own systems to take maximum advantage of what is learned.

The future will likely be found between these two poles. What follows are some strategies that nations large and small, rich and poor, working together or working separately, might consider; that lie along the dimension line between a strict optimisation strategy and a 'greenfield' strategy requiring the design and development of fundamentally new designs for national education systems. Along the way, I will comment on the feasibility of each of these strategies.

How likely is it that the 'Optimisation Option' will enable the top performers to avoid the 'steadily increasing-cost-with-no-improvement-in-results' trap?

This is the first of the two strategies mentioned above. It would involve a major, sustained benchmarking research program, conducted by individual countries or consortia of countries, designed to identify the most effective features of the education systems that now top the PISA league tables, and which continue to show steady progress. Nations would use that research to substantially improve average student achievement, equity and system productivity in their own system.

This is a challenging task for many reasons, not least because effective systems are effective not just because their components are separately effective but because they are designed to work in harmony with each other and with the context for which they are designed. A fuel injection system that works well in one car will not necessarily work well in another. A set of policies designed to address climate change in a country that can easily produce cheap electricity from renewable sources can adopt policies that may not be available to countries in which those renewable sources will be scarcer and much more expensive. Nonetheless, there is good reason to believe that most high-income countries could substantially improve their education outcomes by carefully studying the systems of the current top performers and redesigning their own systems to take maximum advantage of

what is learned. Unfortunately, while there is a lot of research on the components of education systems, there is very little research on the effectiveness of education system designs at the level of the nation, state or province. If nations are going to rely on the optimisation strategy for big improvements in outcomes, they will have to considerably increase their investment in research on large-scale education system design and effectiveness.

There is good reason, however, to believe that very few countries have the will and the capacity to fully implement the optimisation strategy and most will not pursue it at all. Here are only a few of the reasons for that conclusion.

First, as noted, there is a very strong aversion in many countries to a strong role for the ministry or indeed for the central government in education. That aversion is often influenced by beliefs held by many committed educators. These often include a belief that education issues should be kept out of politics and education decisions should be made by educators, not politicians. Demands for accountability are often interpreted as a lack of trust in teachers. Structured curriculum frameworks are viewed as unduly restricting teachers' professional judgement. Standardised tests and examinations are viewed as restraints on student agency that promote needless anxiety and fear among students. All these structures and many others are often viewed as parts of a mass education system that fails to recognise the needs and aspirations of the whole child and the caring teacher. If government does not have the legitimacy needed to lead in the design and implementation of major new policies intended to enable the nation's education system to adapt to major changes in the policy environment, then those changes will not be made or will not be implemented well.

Second, there are many vested interests who would rather keep a system they do not like but know how to negotiate, rather than be willing to take their chances on a new system.

Third, most parents in most countries think the system is working pretty well for them and their children, although, these days, some may be concerned about the schools' response to COVID. The more wealth and power these parents have, the more likely it is that they are happy. Those who are the least happy with the performance of their education system are typically those with the least power and influence. That is a formula for stasis.

The institution that is most in need of complete renovation is probably the school of education in the universities; but these institutions are typically very well-insulated from government political initiatives, by hundreds of years of tradition around academic freedom.

Could the tech giants lead the way to transformed education systems?

Some people have suggested that, all of this being true, nations should go to the world's leading digital technology firms for fresh ideas and better ways to organise and manage the enterprise. However, the big tech companies have strong incentives to sell products to the schools – products that they developed for other markets. Their oligopolistic market positions make it possible for them to do this with big margins at low cost, with virtually no risk. I believe that the leading tech firms could mobilise the capacity to reinvent the whole process of education in ways that could radically improve outcomes for hundreds of millions of students, an enormous new market for them, but they have no incentive to invest the very large sums that would enable them to come up with the highly innovative intelligent systems that

would be needed. That is because they can see that they would almost certainly come up with products and systems they could not sell to governments. Governments would be very unlikely to make the sweeping changes in policy and practice required to take advantage of the radically different approaches to education that would almost certainly emerge from an industry-led development process. Better to sell existing products and services that need only modest modifications to fit neatly into the old system, rather than attempt to develop a whole new, much more powerful system for which they might have no customers.

Could nations contract with privately owned and managed school systems organised to operate high-performance schools at scale?

GEMS Education is the largest private operator of K–12 schools in the world. Its schools offer students a choice among world-class English language examination systems aligned with curricula designed to enable students to perform well on the examinations, which are honoured by leading universities and employers around the world. GEMS has a research and development arm that is actively exploring the use of advanced digital technologies to transform students' learning experiences. It has a partnership with a leading university that allows its students, anywhere in the world, to take courses at that university for university credit. It has partnerships with IBM and other leading business organisations designed to enable students to develop both the cognitive and non-cognitive qualities that leading employers will be looking for.

Because few education ministries in high-wage, high-skill countries would be willing to contract out the education of their education of their children to any firm, GEMS has focused on countries with very poor education systems that are sitting on a wealth of natural resources and are eager to prepare their citizens for the day when those natural resources are gone or no longer being bought.

Ventures like GEMS, unencumbered by many of the negative incentive patterns I described that face most governments and the big digital firms, could help vault countries with money but poor education systems into the first tier. This is a narrow but attractive market. However, there are major challenges here, too. Companies that operate private schools can select the students that are most likely to succeed in their programs and the parents that can afford their charges, but public systems must educate everyone. To get the results for everyone that they now get with a select few, such private firms will need a national cadre of first-rate teachers, a fair school finance system, students who come to school healthy and ready to learn, a labour market that can absorb their graduates, a higher education system that is aligned with the primary and secondary school system, and a vocational education system that has the full participation of the nation's employers. An external contractor controls none of these and other important factors.

Does this mean that this strategy will not work? No. It means that it will work only if the firms are able to develop policy and consulting arms that have the technical and political skill to work with governments at the highest level, to make the changes in government policy and practice that will be needed for their schools to be successful. In many cases, that will require taking on stongly held beliefs and values and powerful political interests. Can that be done? Will GEMS be able to expand beyond the narrow market it has thus far targeted? Stay tuned.

The 'Greenfield Option': Could nations working together accomplish what none could accomplish alone?

Will the optimisation model work? That depends on two things. The first is whether the future is significantly different from the recent past. The second is the degree to which any given government has the authority, support and capacity to lead the way to appropriate goals in an unpredictable world.

If I were in charge of government in one of the few countries that is now among the world leaders on the PISA league tables and which has been experiencing steady improvement through the years, I would stay on course, doing my best to anticipate what is coming next in the context for education policy, and adapting to changing requirements as those requirements emerge. The danger of proposing major changes in direction is that it might undermine the confidence of top political leaders and the public in the winning system now in place, and, given the obvious success of the current system in the current context, cause many critics to ask why any sane person would want to change a system that is obviously working. It might be wiser to keep focusing on incremental improvements to a clearly superior system, while at the same time finding a way to participate in efforts led by others to generate new, breakthrough models of education that might or might not pay off.

However, that leaves us with the challenge with which we began. What if the future really is very different from the past? What if it is true that public education systems now have to find a way to shift the whole student performance curve over to the right, with little or no more money than they have now? Will successful adaptation to this changing context require a revolution –not evolution – in the shape and design of education systems?

We need to be clearheaded as we ask this question. Moving the distribution of student performance way over to the right is another way of saying that we need to make breakthrough advances in the productivity of our education systems. Yet the needle has been pointing in the opposite direction – toward decreasing productivity – as we continue to produce the same results at a steadily increasing price.

What could change that? Most of the much-lauded advances in education technology in recent years have actually consisted of slightly more efficient ways to support the existing delivery system: routinising the gathering and distribution of student performance and administrative data, automating student worksheets, allowing students to step through prepackaged low-level instructional routines when they pass quizzes in the name of 'personalisation', putting teachers and professors on video for synchronous and asynchronous distribution, automated marking of student quizzes and essays, and so on.

The real potential for the use of technology in education lies not in providing support for the present system but in revolutionising it, by creating totally engaging dynamic environments for learning, built on advanced platforms that enable students, as they enter and manipulate those environments, to

- understand very complex systems and the science on which they are based;
- explore the ethical consequences of decisions that they make in those environments;
- understand the positions and motivations of people like them and very unlike them;

- understand how the whole world works and to analyse the worlds inside the machine using different theories and constructs;
- exist in environments in which they have to work closely with their classmates to accomplish common goals;
- gain access instantly to detailed information and analysis that bears on their goals and to contrast and compare it with other information and analysis;
- learn how to use very powerful tools to engage with these environments;
- grasp in a visceral way how events centuries past explain how liberal democracy emerged from much more primitive forms of social organisation and what it takes to keep it together; and much, much more.

Realising this potential will take a very large, heavily funded effort, involving all sorts of specialists and experts, from teachers to software designers to mathematicians and ethicists. Very importantly, to be successful, it will have to be built on a solid foundation laid in the science of learning, meaning a combination of cognitive science and neuroscience, bodies of knowledge that have grown up largely outside the institutions dominated by educators. Much of what is taught to this day in our leading schools of education was long ago disproved by cognitive science.

I have explained above why our leading tech firms are unlikely to make the kind of investments needed to realise this vision and why it will be difficult if not impossible for most national, provincial or state governments to do so. The obvious way to get around these obstacles is some form of collaborative, or for the government of one of the world's largest nations to take on the challenge.

As I also said above, nations that are now in the lead, and continuing to do better, may not wish to take the lead here, but there would be nothing to lose and everything to gain for them to participate with others in a joint effort. For other nations, there is even more to gain by joining such an effort and certainly more to be lost if they fail to emulate the leaders and have no alternative strategy for facing the future.

There is a lot at stake. If the high-wage liberal democracies fail to reduce the ranks of the 'left behind' by giving them the skills they need to compete globally, their governments will lose their legitimacy and with it, their democratic form of government. The more advanced developing countries, countries in which wages are rising and automation is therefore increasingly taking the jobs of people doing routine work, will fail to avoid the 'middle-income gap' if they fail to offer education and training that will turn the machines into partners rather than competitors. Growth will slow and wages will stagnate. Low-wage, low-skill countries that continue to rely on the export of materials in the ground and on low wages rather than high skills to power their economies, will face revolt from populations that see no future for themselves and their families. Whether national governments realise it or not, the challenge of providing a much more effective education for the majority of their people, at a cost they can afford to bear, may be the most important challenge they face. Address it and everything is possible. Fail to address it, and nothing is possible.

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MARC TUCKER

About the author

Marc S Tucker is the founder and CEO Emeritus of the National Center on Education and the Economy in Washington, DC. His professional career has been focused on learning how the world's top-performing education systems produce high student performance with equity and efficiency, and on helping the United States and other nations improve their performance based on that research. He has served in senior positions in the United States government, private foundations and the private sector. He led the creation of the National Board for Professional Teaching Standards, The Commission on the Skills of the American Workforce, New Standards, America's Choice and the National Institute for School Leadership, among other initiatives. Tucker's books include *Thinking for a Living, Education and the Wealth of Nations* – co-authored with Ray Marshall – which won the Sidney Hillman prize and was named by Business Week as one of the 10 best books of the year. Tucker has advised and consulted with governments all over the world. He was awarded the James Bryant Conant prize of the Education Commission of the States in 2014.

About the Paper

The author explores the kinds of changes now taking place that appear to have the most important implications for the design of national education systems, and challenges some of the directions that are being taken. He suggests strategies that nations could use to greatly improve education outcomes for the wide range of young people, at a cost that countries could afford, and explores the possibilities and pitfalls of the politics of implementing those strategies. He emphasises that, while this is not a treatise, it is the 'sketch of a treatise', an attempt to lay out a framework for a debate that he believes is overdue and urgently needed. If it succeeds in stimulating the beginning of that debate, he argues, it will have served its purpose.

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