

# FUTURE

# EDgE

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**A fairer future:**  
ethical thinking in  
a complex world



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# FUTURE EDge

## Contents

About the Authors.....	4
<b>Foreword</b>	
<b>Martin Graham</b> .....	6
<b>Ethical thinking to navigate complexity:</b> part of the student toolkit for an AI age	
<b>Leslie Loble</b> .....	10
<b>Wisdom and ethics in education</b>	
<b>Robert J. Sternberg</b> .....	24
<b>Leading ethical understanding and innovation in schools:</b> insights from a NSW school principal during COVID-19	
<b>Narelle Nies</b> .....	44
<b>Agency and ethics in a complex world</b>	
<b>Catherine Stinson</b> .....	58

# About the Authors



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Martin Graham is currently Acting Deputy Secretary in the NSW Department of Education. Martin has worked in education for 27 years, starting in TAFE NSW and working in policy and planning roles across skills and schooling. For almost two decades, Martin worked on school funding and reform, including the two 'Gonski' agreements. Recently Martin led early childhood education in NSW as it navigated the COVID 19 pandemic.



## **Leslie Loble**

Leslie Loble, recently retired as Deputy Secretary in the NSW Department of Education, has led strategy, reform and innovation in Australia's largest and most diverse education sector for nearly two decades. Leslie instigated Education for a Changing World, a major initiative to ensure that education meets students' needs in a complex future, and established the Catalyst Lab Innovation Program.



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Narelle Nies is the Principal of Revesby Public School. She was featured in the Educator magazine's 2017 'Hot List' for leading her school's participation in the Inclusive Communities Youth Summit, including presenting at NSW Parliament. In 2019, she took part in the department's Catalyst Lab Innovation Program, working on the challenge of ethical citizenship in the time of AI.



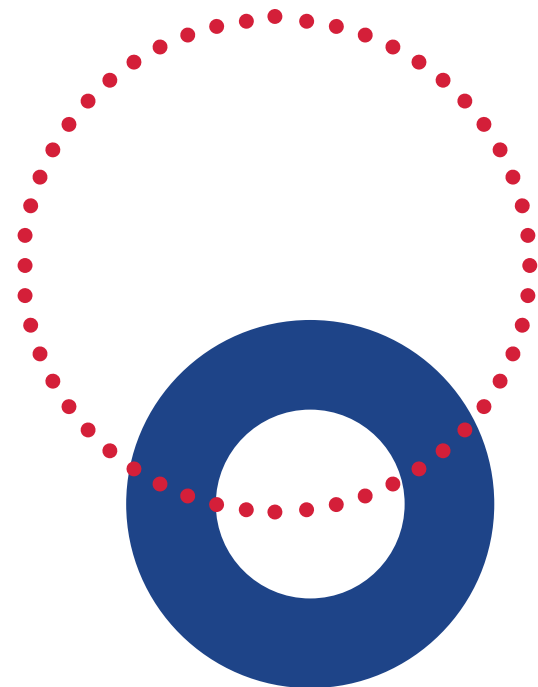
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## Catherine Stinson

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# Foreword

Martin Graham

I sometimes wonder what it would have been like to be an education bureaucrat (a term I use with respect) at key points in history. Imagine being part of introducing compulsory education in the 1880s, or expanding senior secondary education and the HSC in the 1960s. I wonder if the public servants delivering these reforms knew how much they would transform the lives of not only current students, but build a platform for generations of students to come.

There have been several major reforms during my career both nationally and in New South Wales. We built on the legacy of the past in increasing the school leaving age to reflect the increasing importance of education to a student's future success. We finally achieved a kind of settlement to the school funding question through the National School Reform Agreement (Gonski), provided universal access to

subsidised early childhood education in the year before school, and implemented Australia's first national curriculum. These reforms, as with their predecessors, are built on equity and a belief in the power of education to transform lives and break cycles of disadvantage. A great education system is one that guarantees a fair go for every child.

This issue of Future EDge focuses on ethical understanding as it is expressed and taught in the curriculum, and the importance of this capability in preparing young people to shape a fairer future. It is a timely discussion, because it feels as if we are experiencing another historic shift right now. The complex times we are in demand that education lifts the proficiency of all students, so that they develop knowledge and higher-order skills that are complemented (not substituted) by technological change.



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A highly skilled society is the key to securing Australia's economic future, and we will all benefit from significant efforts to lift the bar higher and make education 'smarter'. The recently released New South Wales Curriculum Review sets out an ambitious reform agenda, and a review of the Australian Curriculum is also underway to make sure students finish school with the

knowledge and skills they will need in a rapidly changing world.

The scale of these reforms is once-in-a-generation, but they seek to deliver on some enduring commitments. Late last year, Australia's education ministers signed the Alice Springs (Mparntwe) Education Declaration. This is the fourth expression of this national declaration, first signed in 1989, at about the same time of the last significant HSC reform in New South Wales. The latest agreement has two enduring goals: that the Australian education system promotes excellence and equity; and that all young Australians become confident and creative individuals, successful lifelong learners, and active and informed members of the community.

Equity of opportunity and of outcomes continues to be at the heart of education. Equity is about fairness

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and, as Leslie Loble points out in her contribution to this issue, the ancient symbol of the scales has represented equity for millennia. Today, the image of the scales can be found in the Australian Curriculum and the NSW syllabuses wherever they call out the capability of ethical understanding.

Ethical understanding – which can be thought of as encompassing ethical thinking, reasoning, deliberation, and finally ethical decision-making – is vital for informed and thoughtful citizenship, to which the Mparntwe Declaration recommits education. It is a many-faceted skill that includes the ability to recognise ethical concepts and issues, and make and reflect on ethical decisions. Ethical understanding is not innate: it needs to be actively developed, practised and honed over a lifetime.

Ethical understanding, behaviour and decision-making is embedded in the core values of our department. As an organisation we are committed to the relentless pursuit of equity of student outcomes, but we are also committed to equity in the way we work – respecting diversity and the expertise, experience and views of others; building relationships on trust; acting with honesty and consistency; and holding ourselves to account.

It is crucial that we, as educators and policymakers, hold ourselves to the highest standards to ensure fairness today; but it is the students of today who will need to ensure the fairness of our future.

This issue opens with an article from recently retired Deputy Secretary Leslie Loble, who contributed so much to education reform during her career and has an uncanny ability to see the far horizon, including the challenges and opportunities it will bring. In her article, Leslie reflects on both the ethical challenges and potential benefits of artificial intelligence (AI), and makes the case for why strong education in core content and thinking skills – including ethical understanding – will set our students up to succeed now and into the future. As Leslie notes, school education is not trying to teach students what to think, but rather how to think well. “Ethical thinking is not about providing moral education, which is guided by parents and community and gives children an inherent sense of right and wrong from an early age.” Rather, ethical understanding equips students with the tools they need to make decisions when there is no single clear answer.

Next, one of the world’s leading experts on ethical reasoning – Professor Robert Sternberg from Cornell University – makes the case for educating for wisdom, that is, developing students’ skills in balancing and synthesising diverse perspectives in order to make well-considered decisions in even the most complex of circumstances. He outlines a range of characteristics and thought





processes that are necessary for us to reason and act wisely. Sternberg provides an eight-step model for ethical reasoning (a necessary feature of wise decision-making) and traces its relationship with knowledge, or the 'know how' we need to do things effectively. His article offers teachers a useful framework for conceptualising ethical understanding as a thinking skill, and gives practical suggestions for classroom practice.

Closer to home, we interview one of our expert educators, Revesby Public School Principal Narelle Nies, about how her school integrates ethical understanding into teaching, learning and school culture. Narelle has a passion for equity, and she offers her perspective on why the ability to make ethical decisions is so important for all students. She also reflects on her work with the department's Catalyst Lab Innovation Program, discusses leading her school through COVID-19, and shares her favourite strategies for developing students' ethical understanding skills in the classroom.

Finally, Dr Catherine Stinson from Queen's University in Canada puts forward a range of possible futures for a society that is transformed by advanced technology and artificial intelligence. Stinson argues that we have the power to shape the future in a way that strengthens society, not harms it – highlighting the importance of ethical reasoning being taught in subjects at school. She identifies key responsibilities for education, including developing digital literacy, cultivating social responsibility and preparing young people for the future of work.

I hope you enjoy reading all these contributions. We can't promise any easy solutions to the challenges of our time; but developing the capability to think and act ethically for each of us, in every domain, will be key. In this era of increasing globalisation, technological development and social media, the ability of one person's actions to impact many has never been greater.

# Ethical thinking to navigate complexity:

part of the student  
toolkit for an AI age

Leslie Loble





If you were convicted of a crime, would you prefer to receive a prison sentence determined by a judge or a computer?

Recently, Australian researchers Professor Dan Hunter and Professor Mirko Bagaric from Swinburne University Law School have made a case for the use of AI alongside the role of judges and magistrates in criminal justice. They argue that, when faced with the complex variables of criminal history, education, addiction, motivation and employment, AI makes better sentencing decisions than humans.

If you choose the sentence generated by a computer, you can be sure you will be handed a punishment that is closely consistent with those historically handed down for the offence committed, in the circumstances it occurred. Or you could take a gamble on convincing a

human judge that you, an honourable and trustworthy citizen, deserve a lesser punishment.

Of course, not everyone faces the same odds when standing before a judge. If your inclination when presented with this dilemma was to choose to be sentenced by a human, it is worth interrogating the biases that err in your favour. If your instinct is to dodge discrimination by opting for the impartiality of a computer, you might find yourself equally thwarted. Trained by consideration of hundreds and thousands of decisions made in the past by living judges, a machine that appears to be impartial is actually built on a recorded history of human fallibility.

For Aboriginal and Torres Strait Islander people, for example, the compounding effects of systemic discrimination can stack the deck

for interactions with the criminal justice system. Statistically more likely to be incarcerated, subjected to surveillance, to be victims of crime, and overall experience worse health, education and employment outcomes than the general population: for some, the legacies of deep injustice are inscribed in the factors that a sentencing algorithm might take into consideration. The cumulative impact of centuries of discrimination cannot be unwritten by technology alone.

This year, as governments have fought to contain the spread of COVID-19 and as the Black Lives Matter movement has struck a global chord, there has been a new reckoning about how decisions impacting the community are made and who has the right to challenge those decisions. The two phenomena have exposed and reinforced that those with lesser leverage are burdened with greater risks.


As seismic as COVID-19 and Black Lives Matter have been in 2020, the issues they have raised only scrape the surface of the complexities we will face in coming decades. How do we unwind the effects of chronic ethical failures like race discrimination, even as we speed to keep up in a world transformed by new technologies and their attendant complications? How do we ensure resources, financial or environmental, are equitably accessed, shared and protected? How do we shape both our world and our individual destiny in the face of powerful dynamics we may not directly be able to control?

**Education for a Changing World asks how we can translate this research into real progress towards our shared goal of establishing the NSW education system as one of the best in the world.**

And what do sweeping technological developments suggest about our most human qualities, which must gird our structures, systems and decisions?

As educators, we are preparing young people to live in a world where questions like these are increasingly commonplace. And when it comes to technology, the core infrastructure of our age, we find it offers us powerful tools for disruption and reinvention, but it also generates its own complexities.

Recognising the urgency and impact of big technological shifts, the NSW Education for a Changing World initiative harnesses some of the world's best minds in considering what the accelerating pace of technological growth and wider economic and social change will mean for students in classrooms today. Education for a Changing World asks how we can translate this research into real progress towards our shared goal of establishing the NSW education system as one of the best in the world.



Through Education for a Changing World we have explored critical and creative thinking, computational thinking, and the digital age curriculum. We have developed new ways to improve learning and teaching, supporting classroom educators to make use of innovation strategies in lifting school performance, and have incorporated the best of start-up methodology into one of the world's largest education bureaucracies.

It is fitting that this issue of Future EDge tackles one of the most conceptually challenging of the skills we have identified as essential for young people entering a world shaped by artificial intelligence: ethical deliberation.

The technological optimism that has defined the past half-century of economic development is entwined with an understanding of technology as a multiplier; able to outpace human demands with exponential leaps in efficiency, capacity and innovation, and to converge and transform social and economic ecosystems with startling speed. Just as we have outflanked policy problems of the pre-information age with new tools, we have reason to hope that the rapid pace of technological advancement will continue to germinate new solutions to the increasingly complex problems of our time.

There is no shortage of AI applications that may benefit human culture – AI is a tool and, used well, it enhances our ability to care for one another and supports a fairer and more accessible society. Machine learning and the internet of things have already realised potential applications to streamline diagnostic healthcare and management of complex health issues (including progressing the design of a COVID-19 vaccine). AI brings us closer to fair healthcare by expanding doctors' capacity and reach, and fostering agency and better health outcomes for patients living with chronic conditions.

The same algorithmic pinpointing that enables companies to target product recommendations, and news and social media platforms to funnel content in a feedback loop of our preferences, can also be used to personalise a wide range of services, including education. It can open doors for some of our most vulnerable citizens; for example, through assistive technology for people with disabilities. The potential of AI personalisation has barely begun to be explored in education, but already the Sesame Workshop, the non-profit behind the beloved early learning program Sesame Street, has partnered with IBM to develop a vocabulary learning app which uses AI to align activities to children's learning needs and individual rates of progress.



**There is an imperative to make use of all the tools at our disposal to build an education system that best meets the needs of all learners and especially our most vulnerable students.**

The best of this technology incorporates well-evidenced research, such as cognitive load theory and good teaching techniques, and builds learning from foundational concepts to progressively more difficult content. The software is highly interactive and uses machine learning to adapt to an individual student, keeping them motivated and moving forward. In the context of the well-documented gap in language exposure for children growing up in poverty, which can amount to disadvantaged children hearing three million fewer words spoken over the first three years of their lives, there is an imperative to make use of all the tools at our disposal to build an education system that best meets the needs of all learners and especially our most vulnerable students.

AI may yet hold the potential to improve human decision-making, to make our systems of justice as fair as they should be, even to influence individual human choices for a more inclusive and healthy society. Personalised devices already use biodata to 'nudge' us towards better patterns of sleep and exercise; behavioural economics suggests that AI-powered data insight could enable similar interventions for pro-social action and ethical choices across our communities. Initiatives like MIT and UNICEF Innovation's 'Deep Empathy' project target human emotions with AI – in this case, using machine learning to simulate the impacts of war and natural disaster in a user's own neighbourhood, in an effort to enhance empathy for the survivors of global crisis.

When we look to AI to find new pathways through complex social and historical problems, we need to consider the possibility that these technologies might be just as likely to perpetuate the failures of human justice as they are to mitigate them. This paradox is at the heart of the challenge of AI for educators – what do young people need to know in order to climb the ladders of technology while avoiding all its snakes? There is a clear urgency to teach children the technological skills to navigate a drastically changed workplace and labour market, but this should not be limited to coding or spreadsheets. We must not underestimate less obvious risks to social, political and civic participation that lie coiled in the logics and assumptions of AI.



**Ethical thinking is just one part of an essential set of skills that help students understand the significance of what they learn, and directs them towards meaningful real world applications of their knowledge.**

As machine learning speeds up, drawing on an ever-expanding field of data, it also becomes more opaque to human users. Professor Toby Walsh has called attention to transparency as an ethical problem of deep learning and has sharply raised the profound challenges on the horizon as AI becomes part of the design and deployment of warfare weaponry. The very complexity that allows AI to make decisions means that its networks are barely describable, and its choices extremely difficult to trace. The better AI gets, the larger the share of human functions (including decision-making) it acquires – and the harder it becomes to ensure human oversight and ethical checks and balances.


The thorough deliberation that is a hallmark of ethical understanding is an important brake on the impact of technological transformation. Ethics demands a better answer to why we should pursue innovation than simply because we can. That's why ethical guardrails and incentives are now being built into public policy – for example, the NSW AI Ethics Framework, which will guide agencies

to apply AI to enhance customer service and public trust. There is a similar trend unfolding in executive suites and corporate boardrooms, as with the Commonwealth Bank's recently reported interest in the ethical deployment of AI-based lending software.

Much as innovation needs to be part of how education responds to the sweeping technological changes that shape our economy and society, our work in New South Wales has also underscored the ongoing relevance of the traditional building blocks of education. These include literacy and numeracy skills, which students must master in order to engage with more complex learning, and higher-order thinking skills like critical or computational thinking which enable students to engage with complex opportunities and challenges across their lives.

Just as economic, political and judicial domains grapple with the ethical dimensions of our complex world, education also must bring ethical understanding, deliberation or thinking skills into the toolkit that each student needs for what lies ahead. Ethical thinking is not about providing moral education, which is guided by parents and community, and gives children an inherent sense of right and wrong from an early age. Nor does incorporating ethical thinking skills in the classroom require school students to master the deep philosophical arguments of normative or applied ethics that they may eventually encounter in a university lecture hall.





Ethical thinking or deliberation is about the tools we use to make decisions when there is no one clear answer. Taught in concert with other higher-order cognitive skills like critical and creative thinking, ethical thinking is just one part of an essential set of skills that helps students understand the significance of what they learn, and directs them towards meaningful real-world applications of their knowledge. By illustrating how to identify the dimensions of decisions that might initially appear to be value-neutral, a solid foundation in ethical thinking helps young people become better stewards of the immense technological capability they will inherit.

Much of the promise of AI lies in capabilities that exceed human potential – scanning masses of data in seconds, and calculating probabilities based on a volume of information too large for us to comprehend. Yet sometimes, what a machine does not know may be just as important: machine intelligence offers us clarity that is unadulterated by human experience, bias or fear. That's an opportunity... and a risk.

It is exciting to think that we could use AI to bring logic to the messiness of complex human decision-making. But the blank slate of AI is animated by processes and rules designed by people. If we hope to design our way to a better world, we need to bring ethical rigour to the question of what we think AI needs to know and do.

Trusting the superior processing power of AI means putting our faith in data, which in turn demands external safeguards for the accuracy, comprehensiveness or moral weight of the information it reads. Data is important but neither pure, nor neutral. It can reveal new insights or simply mirror the status quo. Without ethical understanding, we risk making an echo chamber out of the black box of AI, reproducing and amplifying the present and past in ever-tightening feedback loops that define our future.

Dr Simon Longstaff and Dr Matthew Beard point out that technology is not just a thing we build and use, but also a lens through which we view the world. While we may tend to view technology as a type of tool, and believe tools to be value-neutral, when we view the world technologically, our values start to align with those relating to functionality: efficiency, effectiveness and control. As our attention shifts to issues of process, our focus inevitably shifts away from our original intentions, and this ethical challenge only grows as the capacity of technology improves to a level that far exceeds the capacity of humans to understand the operations taking place.

The development and use of facial recognition software is an object lesson in the dangers of innovation for its own sake, if untethered from its ethical implications. Facial recognition technology has caused unanticipated harm, from privacy violations and morally questionable harvesting of facial images, to persistent ethical and legal challenges in its implementation.

Some of the most stubborn problems are bedded down in the system itself: facial recognition technology relies on AI that is often trained on a constrained data set to pick out those facial features that engineers consider distinctive. The systems learn to reliably recognise people who look like the majority of software developers; and they struggle to consistently identify the faces of people of colour, for example.

Beyond the inconvenience of everyday applications like Face ID being less reliable, the risks of misidentification raise the stakes of facial recognition technology. Between 2016 and 2018, for instance, London Metropolitan Police trialled (and subsequently deployed) facial recognition software that 96 percent of the time incorrectly identified people as criminals. Even the MET acknowledged the risks – and promised that humans would always have final accountability.

According to the Georgetown Law Center on Privacy & Technology, one in two American adults are already included in a law enforcement facial recognition network, largely as a result of states providing driver licence and ID photos to federal authorities. Described as a ‘perpetual line-up’, these systems demand participation from everyone who has ever had reason to verify their identity with a government agency. Once captured in these facial recognition databases, citizens have very little power to consent or object to the manner in which their images are used.

The blindness of AI, which holds so much promise when it comes to impartiality, can also be a liability when it is confronted by complex, unpredictable, or context-dependent information. Last year, technological giant Apple found itself in controversy over apparent gender bias at the heart of the predictive algorithm governing credit approval for the Apple credit card. The software – designed to be gender-blind – nonetheless consistently offered women lower credit limits than men in similar circumstances. The trace of gender disparity made its way into the algorithm unintentionally and by proxy: once there, confined to its field of data, the technology lacked the breadth of perspective to correct it.



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## Implications for teaching and learning

Even educational personalisation – among the most socially benevolent and user-centred of current AI applications – may reflect bias if we are not equipped to bring critical rigour and ethical care to its use. Some American colleges have started using predictive analytics in order to target counselling and financial support, and customise academic trajectories to get disadvantaged students over the finish line of graduation. That's a great aim: lifting tertiary graduation rates represents an enormous boost to equity. But the small stories that sit beneath the narrative of the data show a pattern of redirecting students away from demanding and high-status courses, and reproducing disadvantage by channelling them into lower-status, lower-paid, and less secure occupations.

In *Education for a Changing World*, the work on critical and creative thinking keeps us alert to the human tendency towards cognitive bias. Cognitive bias leads to over-reliance on what is familiar to us, whether that is a mode of thinking or a way of using technology. As the old adage goes, when all you have is a hammer, every problem looks like a nail.

When it comes to machine learning, the 'mind' in question is an optimisation engine without the capacity to understand the implications of its increasingly efficient outputs. We have to be especially careful about implicit assumptions, as they may be carved deeply by AI's rapid feedback systems. Technology has no self-reflexive capacity to understand how its systems for pattern recognition or prediction have been shaped by the biases of those who created them, how they have been used in the past, and how this history impacts the use of the systems in the future. Unchecked, what may appear to be logical connections powered by impartial computer processing power may actually be a reversion to a set of outdated and dangerous cultural biases.

The conversation about managing the risks of AI has often been framed as a question of limits: how do we regulate powerful technologies? How can we control, or even justify the use of these tools when they offer us so much and represent such great risk? The challenge to educators and education policy-makers is to flip this on its head – to ask instead how we best protect and enrich human potential alongside these advancements. In education, our concern is always with growth and development, rather than containment and control. It is fitting that we should approach the pitfalls of AI asking what humans need to know, understand and do, rather than focusing on how AI can be stopped.

**For educators, the question of what decisions we can, or should, delegate to AI reignites a perennial concern of education – how do we prepare children to be good citizens and technological stewards?**

For educators, the question of what decisions we can, or should, delegate to AI reignites a perennial concern of education – how do we prepare children to be good citizens and technological stewards? In a world where algorithms might rescind your bank loan, where we may soon grant self-driving cars the power to choose the least-worst option to avert an accident, how should we teach today's students to design and use these powerful tools?

It is critical that we avoid conflating ethical thinking with goodness or rule-following, even though this might be easier said than done in the classroom, where so much unsung work of teachers goes into reinforcing appropriate behaviour to support a positive learning environment. Education can and must go further than transmitting values and rules, to develop ethical understanding as a skill, a habit of thought and a response to uncertainty.

As a capability, ethical understanding offers few easy benchmarks. It is a complex constellation of thinking skills, understandings and capabilities, dynamically adapted to context. Although it is strongly associated with critical thinking, ethical deliberation demands other skills as well: empathy, self-awareness and capacity to apply rigour to our processes as learners, researchers or teachers, whether in problem exploration or reaching conclusions.

Ethical deliberation is a check on antisocial behaviour, but it also lends complexity and challenge to the idea of 'being good'. The critical thinking process of problem-solving is opened and enriched by engaging students' empathy. Learning to reason ethically should make us better thinkers and better decision-makers; at its best, it may also make us better people.

There are deep, mutually reinforcing connections between creative and critical thinking and ethical understanding. Learning opportunities that interweave the different strands of these capabilities prepare students as they come of age in a world full of technological opportunity and risk. While critical thinking empowers students to seek out truth in a mediascape unsettled by deep fake technology, ethical understanding enables them to define a different pathway that places our most human qualities at the centre of decisions.

**While learning to think ethically imposes responsibilities on students, it also enables them to discover rights to fairness and care for themselves and others.**

At a time when personal data has become a commodity concentrated in the holdings of a handful of tech billionaires, and privacy is emerging as a new frontline of human rights law, equipping young people with the ability to identify the winners and losers of an unequal digital playing field is a key part of education. While learning to think ethically imposes responsibilities on students, it also enables them to discover rights to fairness and care for themselves and others. This awareness of self and world is critical both to prevent our young people from becoming collateral victims of the proliferation of AI and big data, and to ensure technology delivers on its positive promise.

The network of skills and habits that we call ethical deliberation is not new. Ethics has a pedigree in education, along with the fundamental skills of literacy and numeracy, that trace back beyond the *ludus litterarius* and *grammaticus* of ancient Rome. Some of the most potent human capabilities in the face of this uncertain new world have the longest history in our classrooms, but historically the

development of these was largely confined to a privileged cohort. In the twenty-first century, it is clear that opportunities to develop sophisticated skills like critical thinking and ethical understanding must be available to all.

The more we look at the future challenges for education in the face of AI, climate change, the global economy, pandemics or the varied and rapid changes that frame modern life, the more we come back to the core of what makes education the powerful engine of progress. A quality education promises to ground community, nation and a generation of innovators in a fundamental structure of continuous capacity for learning: core literacy and numeracy skills, knowledge of content within a range of disciplines, and vital thinking skills including critical and creative thinking, computational thinking and ethical understanding.

Skills like ethical understanding can be hard to isolate, and harder still to measure. That's why great teaching is so essential to our safe passage into a digital future. We need the rigour of evidence-based, research-informed and visionary teaching practices if we are to realise these capabilities. And we mustn't be afraid of new and modern ways to deliver learning. Strong educational standards help us to boost and channel innovation in teaching and learning. When it comes to our technology-defined age, these sorts of teaching practices help us to support students in gaining the knowledge, skill and agency to shape their personal prospects.

**Skills like ethical understanding can be hard to isolate, and harder still to measure. That's why great teaching is so essential to our safe passage into a digital future.**

Why we should care about ethical understanding is a different question from why, and how, we teach it. We know that ethical understanding is still imperfectly understood as a skill, but developing this capability across our education system is part of the response to the rapid change and uncertainty we face as a society.

The challenges are formidable, but there are plenty of ways that machine learning is already facilitating prudent and ethical global citizenship, from real-time tracking of carbon emissions to automated and accessible medical diagnoses more accurate than those provided by even the most expert doctor.

Last year, I discussed ethical citizenship in the age of AI with Dr Simon Longstaff, in a conversation recorded for our Edspresso podcast. Simon raised a hopeful counterpoint to our shared concerns about the future: his belief that the growing sophistication of AI will drive a renewed interest in what makes us human. Questions about how human agency and selfhood are different from machine intelligence are bound

up with questions about the values that guide our lives, what we owe to each other, and how we navigate uncertainty and make difficult choices. That's also what education has at its heart: giving students the knowledge and capabilities that bring agency and optimism to their future, and the certainty they will shape their world.

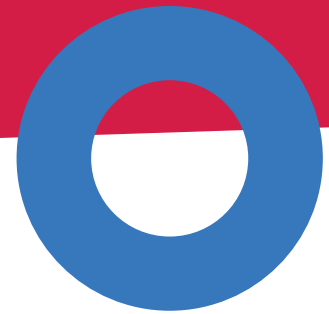
People have often reached for technology to make metaphors for the super-human precision demanded of just decision-making. In the Australian Curriculum and NSW syllabuses, we use the ancient symbol of scales as a shorthand for ethical understanding: measuring the facts against a standard of accuracy we are unable to meet using our mental faculties alone. To think and act ethically is a laborious, heavy, even painful responsibility. The words we use for ethical reasoning describe something effortful – we weigh judgements, wrestle with consequences, deliberate. This can't be outsourced to robots.

The crises we are currently living through have only accelerated the demands for a more skilled, resilient and compassionate workforce. Education for a Changing World is about equipping young people with the skills they need to harness technology to create a better future for all of us. I look forward to seeing the world they create.



# Wisdom and ethics in education

Robert J. Sternberg



## Introduction

Wise decision-making has perhaps never been more important than it is today. In normal times, it may be hard to distinguish the wiser from less wise leaders. It's simply hard to find a metric. But in current times, there are metrics. For example, how much is artificial intelligence (AI) being directed by leaders to positive uses versus negative uses? How many people are learning facts that are true from social media, and how many are accepting falsifications as facts? Wise leaders use AI to benefit their followers; unwise leaders use AI to control and suppress dissent among the people they lead.

In the time of COVID-19, there is another simple metric – deaths per 1 million population. These figures show that developed countries with excellent health systems have not been spared. As Australia introduced new restrictions to deal with the pandemic's 'second wave' in early August 2020, the national figure was still at the low end with fewer than 10 deaths per 1 million population. In the middle, in Germany, it was 110. Toward the higher end, in the United States it was 484, in Spain it was 609, in the UK it was 682, and in Belgium, 850 (Worldometer, 2020). Small differences may be due to variations in health facilities. But the large differences are due, at least in part, to wisdom in leadership – when the threat of COVID-19 was first taken seriously, when social distancing started, and the efficiency of testing and contact tracing.





If we look back at history, we can see that there have always been wiser and less wise leaders. We can also see that, while the agreed list of wise leaders will differ across cultures and countries, that list is invariably much shorter than those who are renowned for their intelligence (Sternberg, 1990). If you want to know who are considered to be wise figures across history, and consult western encyclopedias or even comprehensive volumes on wisdom, you will likely find a fairly consistent set of people on whom the trait is generally conferred: Plato, Socrates, Confucius and Gandhi inevitably among them (Sternberg & Glueck, 2019; Sternberg et al., 2019). In contrast, lists of leaders notable for their intelligence tend to be much more varied and include countless names from across the fields of science, the humanities and the arts, and statesmanship.

Two questions that emerge are: why is the list of wise individuals shorter? And does it matter?

In this article, I will argue that the list of wise individuals is shorter because, in current and many past times, we have failed to satisfactorily develop wisdom in our young people; and that, yes, it does matter greatly. But in order to answer these questions, we first have to consider just what wisdom is.

### What is wisdom?

There have been many different definitions of wisdom over time, and some scholars believe that wisdom is, at least in part, situation-specific (Grossman, 2017): not so much a character trait but a set of responses to certain situations. This would explain why a person who acts with great wisdom in one domain may act foolishly in another.

Recently, Igor Grossmann and his colleagues (2020) have proposed, based on an exhaustive survey of definitions of wisdom, that there are four key features of wisdom:

- Context adaptability – one’s skill in modifying one’s behaviour to suit the everyday life contexts in which one is embedded.
- Perspectivism – one’s skill in considering diverse perspectives on problems and in thinking about problems.
- Dialectical and reflective thinking – one’s skills in balancing and, where possible, integrating conflicting or even opposite arguments, sometimes seeking a synthesis.
- Epistemic humility – seeing one’s own limitations, recognising one’s own biases and correcting them, realising that we all have illusions of things we want to be true but that aren’t.

My own definition of wisdom (Sternberg, 2019) adds some additional features that might be important for a full understanding of wisdom, namely:

- Seeking a common good by balancing one’s own interests with those of others, and with higher-order interests – one sees beyond one’s own selfish needs and the needs of those with whom one immediately identifies; one recognises that tribalism only serves to tear humanity apart.

- Balancing long-term interests with short-term interests – one recognises that what happens in the short term matters, but that if one does not take into account the long-term, one will have committed a possibly grave injustice against not only future generations, but also the future of one’s present generation.
- Infusion of positive ethical values – one realises that there are certain universal ethical principles, such as honesty, sincerity, and the seeking of justice.
- Balancing adaptation to, shaping of, and selection of environments – recognising that the wise course of action is not always to change oneself to suit existing environments (adaptation), but rather that wisdom may consist of shaping the environment to make it better or even selecting a different environment if possible, if the present environment is not one that can be shaped to reflect one’s wisdom-based values.

Of course, the conception of wisdom presented here is not the only one, and other conceptions can be found in the texts already cited. But I believe that the features of wise thinking described above represent a fairly broad consensus view of what scholars today and in the past have meant when they have spoken of wisdom.

So, now we have some sense of what wisdom is. But why should we even care what it is? Why is it important to the world?

## Why is wisdom important?

Why should educators, or anyone else, care what wisdom is? Why does it matter for schools and for the future of the world? Schools at present seem to emphasise wisdom little, if at all, in their teaching (Sternberg, 2013). Rather, they emphasise the development of a knowledge base and, more generally, of intellectual skills needed to acquire and utilise the knowledge base, at least in school settings (Sternberg, 2017). Knowledge base and intellectual skills are obviously important.

**The question is not whether knowledge and conventional intellectual skills are important for schools to teach—of course they are. The question rather is whether that is enough.**

You cannot think if you have no knowledge about which to think, and you also cannot think if you have not learned the skills involved in thinking, such as recognising and extrapolating patterns in data (inductive reasoning) and drawing logical conclusions from data (deductive reasoning). The question is not whether knowledge and conventional intellectual skills are important for schools to teach—of course they are. The question rather is whether that is enough. I would argue that it is not.

## The Flynn effect

During the twentieth century, average intelligence quotients (IQs) rose 30 points (Flynn, 1987). This is a massive increase, discovered by Professor James Flynn of the University of Otago. The difference between an IQ of 100 and 130 is the difference between someone who is classified as just average in IQ and someone who is classified as gifted (or possibly borderline gifted). The difference between an IQ of 100 and 70 is the difference between the average individual and the individual who is classified as on the borderline of living with intellectual disability.

Of course, recorded IQs today, as in 1900, average 100. How can that be? The answer, simply, is that IQ test publishers re-norm their tests every so often, and as raw scores (number of items correctly answered) increased over the years, the publishers just changed what it meant to attain a score of 100. This was straightforward as, in current times, IQs are computed statistically on the basis of departures from the average score, with a mean of 100 and a standard deviation of 15. This standard deviation means that roughly 68% of cases fall within plus or minus one standard deviation of the mean, 95% of cases fall within two standard deviations, and well over 99% (about 99.7% of cases, to be more precise) fall within three standard deviations of the mean. So, the increase in scores in the twentieth century was two standard deviations, truly an incredible rise!



## Problems, problems, problems

Here is the rub. If people are so much smarter today than they were in 1900, for whatever reasons – more education, better nutrition, more exposure to diverse cultures – then why does the world seem to be so immersed in multiple, deep problems that resist solution and that are often addressed in ways that, on the face of it, are inadequate? How can smart people be so foolish? For example, there are many who still see climate change as a distant problem while all the scientific evidence and mainstream political consensus attests to it being a threat now. The Intergovernmental Panel on Climate Change has stated that “scientific evidence for the warming of the climate system is unequivocal” (NASA, n.d.). There is no scientific counterargument. The counterarguments regarding whether global climate change exists

are largely ideological, economic, sociocultural, and so forth, but those are irrelevant to the science of climate change, which, from the standpoint of climate systems, is all that matters.

Worldwide, more than 250,000 people may die a year as a result of climate change (Rettner, 2019). In 2018, carbon dioxide emissions reached an all-time high (Harvey, 2018). As a result of climate change, one million species are at risk of extinction (Fears, 2019). But many governments have been slow to react, and some political entities seem frozen in time with regard to the aggressive measures needed to combat this challenge (Kahn, 2016). Wise leadership requires, in times of crisis, intense focus and commitment to combating the crisis, and moreover, the public perception of the same.

Australia's record-breaking bushfires over the summer of 2019-2020 provided a stark reminder that the threat of climate change is an immediate one. According to the CSIRO (2020), while climate change does not directly cause fires, it has contributed to an increase in extreme fire weather and longer fire seasons. 2019 was both Australia's driest and warmest year on record. Many parts of the country had been in drought for years, which increased vegetation dryness. Fire danger for Australia is predicted to increase as the effects of climate change intensify (National Environmental Science Programme, 2019).

Were climate change the only serious problem we faced as a world, and had intelligence proven adequate to solving this problem, we might worry less about the need for wisdom in the next generation (and, of course, the current one). But the world faces many huge challenges in addition to global climate change, for example:

- **Automation.** Aside from the ongoing COVID-19 crisis, automation is arguably the greatest emerging threat to Australian jobs. CEDA (2015) estimated that more than 5 million jobs would be lost in Australia in 10-15 years due to technological advancement – almost 40% of Australian jobs at the time.
- **Pollution.** Air and water pollution are both serious threats to society, in many cases the result of rapid industrialisation. In some cities, such as New Delhi (Air Matters, 2020), the quality of the air is persistently unhealthy, leading to illness and even death as well as cognitive decline. In 2017, 1.2 million deaths in India were linked to air pollution (World Health Organization, 2019). Clearly, more and better steps are needed, not only in India, but in all cities in which air pollution is a cause of health hazards. Water pollution, too, is a serious threat in much of the world, resulting in severe illnesses and death. The threat is not limited to developing countries. Flint, Michigan, USA had contaminated water as a result of poor water resources decisions, leading to high concentrations of lead that easily could have been avoided (CNN editorial research, 2019).
- **Terrorism.** How can society most effectively combat threats of terrorism, as opposed to taking steps that have the cosmetic appearance of being effective but in fact have little value (US Department of State, 2006)?

- **Bacterial resistance to antibiotics.**

As is well-known, bacteria of various kinds are becoming increasingly resistant to antibiotics (World Health Organization, 2018). An estimated 1600 people die each year in Australia as a result of antibiotic resistant infections (Del Mar et al., 2017). In the United States, the numbers are staggering: at least 2 million antibiotic-resistant infections per year, and 23,000 deaths – the size of an entire medium-sized town (Centers for Disease Control and Prevention, 2019).

- **Income disparity.** Income disparities in many countries have reached absolutely stunning levels. In the United States, for example, the top 10% in income make more than nine times as much as the bottom 90% collectively. The top .1% bring in more than 188 times the bottom 90% (Institute for Policy Studies, n.d.). In Australia, it appears, housing inequality, resulting in large part from income inequality, has been a serious problem (Coates & Chivers, 2019).

- **Decline of democracy.** Democracy as we have known it in the post-World War II era is in decline around the world (Ziblatt & Levitsky, 2018; Mounk, 2018). In the past, problems with democracy were viewed as problems of developing countries. No longer. In the Americas, Europe, Africa, and Asia autocratic governments are on the rise and distrust of politicians has grown.

**What has been missing is an emphasis on wisdom and, in particular, achieving a common good, rather than trying to protect or favour particular groups, whatever those groups may be.**

This list of major current world problems is incomplete, of course. The goal is not to list all of the major problems the world is currently facing. Rather, it is to show that rising IQs and education levels have not been adequate to solve some of our most significant problems. What has been missing is an emphasis on wisdom and, in particular, achieving a common good, rather than trying to protect or favour particular groups, whatever those groups may be. Often, such attempts are disguised as attempts to achieve a common good, but the cover stories are thin (Sternberg, 2018).

If educators care about educating the whole person and about producing the active, concerned citizens of the future who will make the world a better place, we need to do something different, and that means not only promoting wisdom, but combating foolishness (Sternberg, 2016).

## How can smart people be foolish?

We need to take wisdom seriously in our educational system because knowledge and intelligence are not guarantors of wisdom, especially as it pertains to its function of helping to achieve a common good. On the contrary, it has been argued that knowledge and intelligence can actually work against wisdom if erudite people believe they are too smart or too knowledgeable to act foolishly (Aczel, 2019). Because they are as susceptible as less bright people to foolishness, more intelligent people may actually fall into the trap of believing they are immune when they are not.

What is foolishness? One account seeks to understand it in terms of cognitive fallacies, in particular (Sternberg, 2005):

- **Unrealistic optimism fallacy.** The individuals believe that they are too smart to have bad ideas, so are unrealistically optimistic about any ideas they have, figuring that if they have them, the ideas must be good.
- **Egocentrism fallacy.** The individuals believe that it is all about them. Their world centres on them. Hence, they look at future courses of action in terms of how those courses of action benefit them (or those with whom they identify, such as family and friends) personally.
- **Omniscience fallacy.** The individuals believe they are all-knowing, at least with respect to the issues with which they need to deal. They rarely seek advice, and if they do, they do not take the advice seriously. They trust their instincts and distrust the expertise of others.
- **Omnipotence fallacy.** The individuals believe they are all-powerful – that they can do whatever they want, either because of a position of power, an imagined position of power, or their view that their omniscience gives them the power to do whatever they want.
- **Invulnerability fallacy.** The individuals believe that there will be no adverse consequences to what they do, no matter what it is. They believe they are above being attacked, or at least, being attacked successfully. Rather, they believe they can easily crush any opposition.
- **Sunk-cost fallacy.** Having invested in a course of action that has proven to be ineffective or even dysfunctional or dangerous, they continue to do what they did before because they have invested so much in their prior course of action.

If people could easily recognise foolish behaviour on the part of their leaders, the problems of today would be much less serious. But, regrettably, people often support potential leaders who are extremely self-confident, charismatic or even narcissistic over those who are competent and constructive. We need wiser leaders, but is wisdom even a stable personal characteristic, or is it so labile and so situation-specific that one can neither teach it nor select leaders for it?

### How general across domains and stable is wisdom?

If, as some theorists believe, wisdom is largely situational, it might seem that there is nothing educators could do to develop it. They could not possibly put students into every possible situation that the students might encounter in their future lives. At the same time, if wisdom is entirely dispositional and those dispositions are set early, then also school educators might be able to do little. So, what is the potential role of educators in developing wisdom?

Wisdom clearly has situational elements. If any of us were placed in another culture, in which we had no idea of what the norms were or what was considered allowable or not, we would scarcely be in a position to wisely mediate disputes in that culture. We would not know the grounds upon which one person or another might be viewed as having a stronger position or a weaker position. But, I would argue, this is not because wisdom simply is situational,

but rather because wisdom draws on a kind of knowledge about which we would have little or none in that culture – namely, tacit knowledge.

Tacit knowledge is what one needs to know to adapt in a particular environmental context that is not explicitly taught and that usually is not even verbalised. It is procedural knowledge – ‘know how’ – rather than declarative knowledge – ‘knowing that’ (Ryle, 1945). Tacit knowledge is informal rather than formal – it is typically acquired through everyday experience rather than through a classroom, although there is no particular reason it could not be taught in a classroom (Sternberg et al., 2000). Examples of tacit knowledge are how to act in a job interview, how to persuade your spouse to agree to a purchase you want to make, and how to get your children to stop behaving in ways that drive you crazy. Tacit knowledge is learned from experience, but experience is not sufficient for one to acquire tacit knowledge. What matters is not having an experience, but rather learning from the experience and then applying that knowledge in the future.

There are certainly books that attempt to teach tacit knowledge, especially for professionals (Sternberg & Horvath, 1999) and for those entering various kinds of careers (Sternberg, 2016). One volume attempts to teach tacit knowledge, also sometimes called ‘practical intelligence’ or just plain ‘common sense’, for success in school (Williams et al., 1996).



Although tacit knowledge is situationally bound, it can be applied to classes of situations, not just specific situations. For example, at least in our society, it is unwise to ask someone, upon first meeting them, what their weight or age is. That lack of wisdom would apply across many different situations, although not all, as such a question would be totally appropriate for a physician to ask. In many kinds of job interviews, it would be quite reasonable to ask for starting salary, but not in one that is clearly labelled as volunteer work.

Wisdom is based on tacit knowledge. To understand how to act wisely in a particular situation, one must have tacit knowledge about that situation and the context in which it has evolved. What is the difference between tacit and explicit knowledge? As an example, a teacher learns a great deal of explicit knowledge about subject matter and even some explicit knowledge about how to teach it in studying to be a teacher. What the teacher may not explicitly learn is the tacit knowledge of what to do when students start throwing paper airplanes, what to do when a student questions the teacher's authority, or what to do when parents explain how much better they understand their children's strengths than the teacher does. Much of the training of various kinds of therapists and counsellors is really in helping them develop tacit knowledge, and internships often are required because so much of what one needs to counsel people is learned largely or exclusively through

**Wisdom is based on tacit knowledge. To understand how to act wisely in a particular situation, one must have tacit knowledge about that situation and the context in which it has evolved.**

experience. Training of teachers also should emphasise acquisition of tacit knowledge, because initial teacher education can never prepare teachers to handle every situation that might arise.

Tacit knowledge for wisdom virtually always involves issues that affect living organisms, not just elements of the physical world. There may be better or worse ways of preserving rocks, for example, but wisdom would be relevant to preserving people and their lives rather than preserving rocks. This is in part because ethical issues arise in one's treatment of living things but, arguably, not in one's treatment of rocks – except, perhaps, those that have significance for some people. For example, a teacher needs to act ethically toward the children they teach, but not toward, say, a rock used in teaching earth science that happens to be on display in the classroom.

## Ethical reasoning in wisdom

Wisdom draws upon ethical reasoning, which is importantly embedded in the Australian national curriculum and NSW syllabuses through the ethical understanding general capability.

Ethical reasoning, in turn, draws on tacit knowledge. Wise courses of action take into account the ethics of the situation and the people involved in the situation. I have argued that ethical reasoning involves a set of steps that may vary in order from one situation to another, but that generally need to be recruited in handling problems ethically. These steps are as follows (Sternberg, 2010; Sternberg, 2011; Sternberg, 2012):

### 1 **Recognise that there is an event to which to react**

First, one has to recognise that there is an event or situation to which one needs to react. For example, if a student copies material from another student directly into his or her own assessment task, the student may not even think twice about it or have any second thoughts because the student never learned that doing so might pose a problem for the teacher or the other student.

**Wisdom draws upon ethical reasoning, which is importantly embedded in the Australian national curriculum and NSW syllabuses through the ethical understanding general capability.**

### 2 **Define the event as having an ethical dimension**

Second, one needs to define the event or situation in question as having an ethical dimension. For example, the student who copied from their classmate may recognise that there is an event that needs further reflection but may view the event pragmatically rather than ethically: Will he or she get caught? That is, the student does not care about the ethics of what they did but rather about the pragmatics of getting away with it.

### 3 **Take personal responsibility for generating an ethical solution to the problem**

Third, one needs to take personal responsibility for the problem that has arisen – that it is one's responsibility to deal with the problem. For example, in the copying situation, the student may view the problem as the teacher's, not theirs. In other words, it is up to the teacher to discover copying and if the teacher does not discover it, it need concern the student no further.

#### **4 Decide that the ethical dimension is of sufficient significance to merit an ethics-guided response**

Fourth, the individual has to decide that the situation is important enough to be worth pursuing further. Even if the student does decide the situation is personally relevant, the student may decide that the situation is not sufficiently important to think about it any further. The student may feel that all their friends do the same thing and that as a result it is not even worth any further thought. After all, if heaps of people do it, what's the big deal?

#### **5 Figure out what abstract ethical rule(s) might apply to the problem**

Fifth, one has to decide on the abstract ethical rule that applies. Here, the student may realise that the situation is an ethical one and may know that one should not copy, but not know exactly what the rule is. Is it that one cannot copy at all? That one can copy but needs to put the material in their own words? That one can copy but has to attribute the source? Or what? In other words, the student is aware of an ethical boundary but is not clear on what it is.

#### **6 Decide how these abstract ethical rules actually apply to the problem so as to suggest a concrete solution**

Sixth, one has to figure out not just what the ethical rule is, but also how to apply it. The student may know the rule but wonder whether

the rule only applies to papers that are going to be published, as opposed to papers turned in for classes. Or the student may wonder what, exactly, is the limit on copied material.

#### **7 Prepare for later possible repercussions of having acted in what one considers an ethical manner**

Seventh, ethical behaviour sometimes results in serious repercussions. The student has to prepare for possible repercussions of acting ethically. For example, the student may be afraid that if he or she does not copy, the student will get a bad grade for lack of any ideas of their own. Or the student may feel that not copying puts them at a disadvantage because some of their classmates seem to be copying. Or the student may already have copied, and realise that if they confess, the consequences may be worse than if they said nothing.

#### **8 Enact the ethical solution**

Finally, people have to decide whether to act. Often, they know what the ethical thing to do is, but don't do it, perhaps for fear of repercussions, or perhaps for fear that they will make a bad situation worse. In the case of the student, they ultimately have to decide whether to act in an ethical way.

None of this sounds that hard in principle. So, why is it so hard in practice? There are at least four reasons, and students need to understand why ethical behaviour is often hard, not easy.

- 1 Ethical behaviour is multi-step.** Often people say, “Just do the right thing.” But, according to this analysis, doing the right thing is not simple, but rather complex. It involves eight steps.
- 2 If any steps are missing, people probably won’t behave ethically.** People have to do it all to act ethically. They can’t skip steps. They have to recognise there is a problem. They have to see it as an ethical problem. They have to decide the problem is relevant to them and that it’s worth their effort. And so on.
- 3 People often decide that the consequences of ethical action are too high.** We only have to look at the horrors of Nazism to see that, in certain contexts, many people will not act on their ethical principles: choosing instead to adopt accepted (though unethical) practices or, more often, to remain quiet.
- 4 People may even decide on the right course of action and then just fail to act.** It is not enough to know the right thing to do; people have to do it. Many do not.

We have seen that wise and ethical behaviour is a challenge. How does one teach young people to understand these challenges and to meet them head-on?

## Teaching for wisdom and ethical reasoning

If one believes, as I do, that the problems of the world require wisdom and ethical reasoning, not just knowledge and conventional intelligence for their satisfactory solution, then it makes sense to teach for wisdom and ethical reasoning in school. Some people might argue, of course, that such thinking already is taught at home or in religious settings. But how many parents feel well-equipped to teach for wisdom and ethical reasoning? And when such teaching occurs in a religious context, how much of the teaching is shaded by the religious precepts of a particular group? Even if children do some learning of wise and ethical thinking at home or in religious school, the problems of the world do not seem to be in the process of being solved by such teaching alone. More needs to be done.

## What to teach

To review, a curriculum which builds wisdom involves teaching young people, at minimum, the following skills, as described earlier in this essay:

- Context adaptability
- Perspectivism
- Dialectical and reflective thinking
- Epistemic humility
- Seeking a common good
- Balancing one’s own, others’, and higher order interests
- Thinking for the long-term as well as the short-term



- Balancing skills of adapting to, shaping, and selecting environments
- Infusion of ethical thinking (according to the model described above) into one's wise thinking.

There are two basic models that education systems can use for teaching wisdom and ethical reasoning: the separate instruction and the integrated instruction models. Both have their proponents and detractors because they highlight different things. Ideally, there would be some of both.

### Teaching for wisdom and ethics as separate instructional modules

One way of teaching wisdom and ethics is through separate instruction. This is the basis of the Philosophy for Children program (Lippman, 1980; Lippman, 1985). The program presents

a series of books in which children try to solve problems they encounter in their lives through critical thinking and wise reasoning. The children act in the role of junior philosophers. The goal is to encourage children to think philosophically and to develop the wisdom-based skills inherent in philosophical thinking.

There are also more recent versions of programs to teach children about philosophy (Davey, 2015). Like Philosophy for Children, they attempt to teach wise and philosophical thinking. But they draw on the works of great philosophical thinkers without the mediation of novels about children and their problems.

Separate courses have three main advantages. First, they are intensive. They concentrate exclusively on teaching wise philosophically-based thinking. Second, they typically are programmed in

some way so that each unit builds on previous ones – that is, they are designed for pedagogical soundness. Third, they signal the value of focusing on wisdom and guarantee that wise thinking is explicitly addressed.

There are also disadvantages to teaching wisdom and ethics separately. First, students may not see how to apply what they learn to course material or, actually, any of the knowledge they acquire inside or outside of school. Put another way, transfer of training may fail to occur. Transfer is likely to occur only if students see how directly to apply what they are learning to situations in their own lives. Abstract ethical principles are meaningful only when people can see how to apply them. Second, schools already have much to teach and may not have time slots for separate teaching wisdom programs. Third, there may be a shortage of qualified personnel to teach a separate course on wisdom and ethical reasoning. Fourth, if state or national tests do not test for wisdom and ethical reasoning, administrators may be reluctant to devote the time to such teaching that a separate course might require.

An alternative way of teaching wisdom is to embed it into existing course content, as is already the case in Australia through the ethical understanding general capability and as we have done in the United States with American history (Sternberg et al., 2008). As a positive example, President Abraham Lincoln had to decide whether he would find a way

**Given the importance of teaching for wisdom and ethics to the future of us all, NSW syllabus reform presents a timely opportunity to consider a greater role for the teaching of wisdom in schools in a way that is embedded into subjects.**

to bring a divided country together, even at the cost of war, or let it split and thereby also let slavery continue. He wisely decided that unity and ending slavery were more important than keeping people who were willing to enslave others happy. As a negative and contrastive example, Andrew Jackson's treatment of indigenous Americans was a disgrace – he sent them on the so-called Trail of Tears – and resulted in many deaths and a message of disrespect for the lives of those who differed from later settlers in skin colour and ethnicity (History.com Editors, 2020).

In Australia, the recent NSW Curriculum Review points to the need to ensure that syllabuses focus learning opportunities on essential core content and skills, and also calls for general capabilities to be integrated even more deeply into subject content. Given the importance of teaching for wisdom and ethics to the future of us all, NSW syllabus reform presents a timely opportunity to consider a greater role for the

teaching of wisdom in schools in a way that is embedded into subjects.

The advantages of integrated teaching are complementary to those of separate teaching. First, students see how to apply what they learn to the material they are learning in school. There is thus, automatically, at least some transfer of training. Second, teachers may be more confident in teaching wisdom if it is embedded in course content. Ideally, this focus in schools would send the message that teaching for wise thinking is important and may help enrich content learning. Third, one does not need a separate time slot for instruction.

Integrated teaching however also presents challenges. Teachers may need more support in how to teach for wisdom and ethics through core content in the syllabus – including through initial teacher training programs and ongoing professional learning. Without a specific focus on wisdom, it may get lost amongst the other important content and skills that students need to learn.

### Activities in wisdom-based teaching

Teaching for wisdom and ethical reasoning ideally involves opportunities for student discussion and could include project-based learning approaches. Students could explore ethical themes – linked to content they are learning – through guided conversations with their peers and teachers. The kinds of problems used can be either

**Teaching for wisdom and ethical reasoning ideally involves opportunities for student discussion and could include project-based learning approaches.**

personal wisdom problems or societal wisdom problems.

Examples of personal wisdom problems are:

- **Friends.** You have two friends who are both important to you. But the friends do not get along with each other. You are beginning to feel like each friend is pressuring you to drop the other friend. You would like to maintain the friendships, but you are now feeling very uncomfortable. What should you say and do?
- **Teacher.** Your teacher has accused you of misbehaviour that you know you didn't do but rather that a friend of yours did. You feel that you are in trouble because of your friend's misbehavior. The friend is unwilling to go to the teacher and confess that it was them who misbehaved. What should you say and do?
- **Sibling.** You had an argument with your sibling. You believe they were unreasonable. They think you were unreasonable. Now, you are not talking much to each other and a cloud hangs over your relationship. You do

not want to have bad relations with your sibling. But you believe that your side of the argument was correct, and your sibling believes their side was reasonable. What should you say and do?

Societal wisdom problems will generally require students to do group and/or independent research. Some examples are:

- **Global climate change.** You are aware that global climate change is causing, directly or indirectly, a number of problems for the world, such as bushfires, more severe storms, coastal flooding, and rising temperatures that are problematic for animal life and plant life alike. What can you do personally to make at least a small contribution to combating climate change? What can government or other agencies do? What are the obstacles or other factors that make combating climate change challenging for societies?
- **Antibiotic resistance.** You are aware that antibiotic resistance on the part of various kinds of bacteria is causing illnesses that resist medical treatment. Some people are remaining sick; others are dying. What can you do personally to make at least a small contribution to controlling antibiotic resistance? What can government and other agencies do? What are the obstacles or other factors that make combating antibiotic resistance challenging for societies?

- **Air and water pollution.** You are aware that air and water pollution are causing problems for people, including even illnesses and deaths. What can you do personally to make at least a small contribution to reducing air and water pollution? What can government and other agencies do? What are the obstacles or other factors that make combating air and water pollution challenging?
- **Poverty.** You know that poverty is a problem in all parts of the world. It affects some people but not others. It especially affects children whose parents do not have the resources to properly educate and take care of them. What can you do personally to make at least a small difference to helping to reduce poverty? What can government or other agencies do? What are the obstacles or other factors that make combating poverty challenging?

How does one evaluate responses to wisdom-based questions? One evaluates them not in terms of correct versus incorrect answers, but rather in terms of how the answer satisfies the criteria for wise thinking:

- 1 Does the solution help to achieve a common good for all affected parties?
- 2 Does the solution balance the interests of the protagonist with the interests of others and with larger interests?



- 3 Does the solution balance long-term interests with short-term interests, with recognition that sometimes these two kinds of interests conflict with each other?
- 4 Does the solution display the infusion of positive ethical principles?
- 5 Can the solution be put into action in an efficacious and equitable way so that the action contributes to changing the world or some part of it for the better?

## Conclusion

The world is facing many pressing problems. Our societies have made good progress in addressing some of these issues; other issues have not been addressed as successfully. Wisdom and ethical thinking can be keys to addressing these problems. Wise and ethical thinking may not guarantee solutions, but they certainly would help. And it has become clear that knowledge and IQ, whatever they will do, will not alone solve our problems. If not wisdom, what? Our time as a world for seriously addressing these problems is running out. It's time to give teaching for wisdom a try.

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# Leading ethical understanding and innovation in schools:

insights from a NSW school principal during COVID-19

Narelle Nies





Narelle Nies is the Principal of Revesby Public School, and a leading educator with a passion for developing her students into ethical citizens. In 2019, Narelle and some of her colleagues from Revesby Public School took part in the Incubation Stream of the department's Catalyst Lab Innovation Program, working on the challenge of ethical citizenship in the time of AI.

The Future EDge team spoke to Narelle about her views on why ethical understanding is so important for students to develop. We discussed what inspired her passion for it; how teachers can be better supported to develop students' ethical understanding capabilities; and what the uncertain times of COVID-19 can teach us about the role of innovation and ethical understanding in education.

### **You've been Principal of Revesby Public School since 2017. Could you describe your school community for us?**

Our school community is magical. We are highly multicultural. We have 78 per cent of students from a non-English speaking background, which makes Revesby Public School very, very diverse. It's rich in its culture. I think what's special about our school is the way that we value what each and every student and family brings. We try to draw upon those cultural experiences and make sure that they



enrich what it is that we do within our school through intercultural activities. We make sure that everyone in our school community has a voice and is included in decision-making. We're really big on student agency, making sure that our students have a voice, and making sure that voice is not only heard, but acted upon. It's a wonderful school community in terms of staff, ranging from a few beginning teachers right through to teachers bordering on retirement and everything in between.

You are well known as an innovative educational leader focused on developing your students into ethical citizens who are engaged in the world around them. In your first year as Principal of Revesby Public School, you earned a place on the Educator magazine's 2017 'Hot List' for leading your school's participation in the Inclusive Communities Summit. Students worked with members of their community, including religious leaders and Aboriginal elders, to develop a cultural inclusivity plan for the school – and presented their plan at NSW Parliament.

## What inspired your passion for developing students' ethical citizenship capabilities?

I think at the heart of my leadership is a passion for equity, and what drives equity is developing empathy and an ability to make ethical decisions. The Melbourne Declaration on the Educational Goals for Young Australians (2008), and now the Alice Springs (Mparntwe) Declaration (2019), has always had a large impact on my teaching and leadership in fostering the development of 'personal values and attributes such as honesty, resilience, empathy and respect for others'. It is critical, in preparing our students for a changing world, that they live their lives with ethical integrity. My strong belief is that when we are preparing our students, it is no longer just about the three R's (reading, writing, arithmetic) – it is much more complex than that. For our young people to be able to thrive in an increasingly complex and interconnected world, we must equip students with the tools and skills to think ethically about a variety of challenging situations. We must provide opportunities for students to manage conflict and uncertainty. The challenges that we have experienced in 2020 show that being able to navigate an uncertain world is critically important.

More than ever, we need our young people to understand how interconnected our world is and that their actions have consequences for others. This is imperative if our young people are to be accountable community members, or even

**It is critical, in preparing our students for a changing world, that they live their lives with ethical integrity.**

global citizens. We need to create situations for our students to practice ethical reasoning and decision-making so that when they are faced with the real thing, they have a framework to make their way through these situations. I think it's important that within each school there is leadership providing opportunities for students to develop ethical understanding.

## Why do you think that strong ethical decision-making skills are so important for students to develop? Is the need becoming more urgent as the world becomes more reliant on technology?

There is definitely a sense of urgency for our students to develop the skills for making ethical decisions. Complex issues such as human rights and responsibilities, environmental issues and global justice require ethical considerations and students need to be equipped with the appropriate skills to be able to navigate these complex contexts. These are big and difficult topics that cannot be discussed, considered or decided upon without engaging in ethical decision-making. That is why it is critical that we develop our students' ethical understanding capabilities.

# WE BELONG



Artificial intelligence, robotics and automation may become disruptive if we don't equip our students with the ability to be ethical decision makers. By the time our Kindergarten students finish their schooling, it is likely that all parts of the labour market will have been affected by further automation and artificial intelligence. Our students will need to understand artificial intelligence, where it is used, how to identify its biases, and be able to make ethical decisions based on this information. So in this regard it is not about preparing our students for specific jobs, but rather helping them to be critical and ethical. If our students understand technology is a tool, and we equip them with the skills to make ethical decisions, we will be preparing them to be adaptable learners who will be able to navigate a multitude of careers and jobs.

Really, we are preparing young people for a world that is barely imaginable, and it is so important that our students can navigate this uncertainty equipped with strong critical, creative and ethical thinking capabilities.

**Ethical understanding is one of the seven general capabilities in the Australian Curriculum, and it's expected to be taught within different subjects and across stages of learning.**

**How do you define ethical understanding, and to what extent do you think it intersects with other general capabilities such as critical thinking or intercultural understanding? Do you think it's more effectively taught in some subjects than others?**



**Ethical understanding is, firstly, the ability to recognise, understand and explore ethical concepts and issues. Ethical understanding is also the ability to reason in decision-making, consider consequences and various viewpoints, and reflect on one's own actions.**

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There is significant overlap between all of the general capabilities, so much so that you can't have some without the others. In terms of ethical understanding, I think critical and creative thinking is the most closely related. If you are someone who demonstrates ethical understanding, you are thinking creatively and critically, you're posing questions, you're looking at different points of view, different perspectives. So those two are very closely aligned.

Ethical understanding is also closely linked to personal and social capability. Ethics pushes us to think about not only how our decisions affect ourselves, but how they affect the community. So asking ourselves those questions takes us beyond our own views, and that's what personal and social capability does. Intercultural understanding also has strong links, as does literacy – texts and stories are a key way that students can be presented with ethical scenarios. That only leaves numeracy and ICT, and it could be argued that they are connected to ethical understanding as well, although perhaps to a lesser extent.

I think that ethical understanding is at the heart of the curriculum and should be embedded into all subjects. In the classroom, the focus should be on analysing and evaluating the ethical actions and motivations of individuals and groups. Approaches include having students debate ethical dilemmas and scenarios, and providing them with opportunities to apply ethics to a range of situations. The important thing to remember is that the curriculum lends itself to discussing ideas and exploring issues that support students to become ethical citizens. The key is providing regular opportunities to identify and make sense of the ethical decision-making and understanding in their learning.

There are strong links right across the curriculum. From a primary perspective, ethical understanding can be explored across all the key learning areas (KLAs):

- **English.** Through the English KLA, students develop ethical understanding through investigating ethical positions and dilemmas through a variety of texts. Students can look at the ethical behaviour of fictional characters and potentially compare them with their own experiences. This KLA provides a rich opportunity to discuss ethical decisions, in which students express their own points of view and consider the views of others. In English students also learn how language can reflect bias, and influence judgements and opinions. Language is critical to ethical understanding in the way that it can be either helpful or hurtful to others.
- **Mathematics.** While some may question where ethical understanding lives within mathematics, it is there when we look for bias presented in data and statistics, investigate comparisons and fairness and look at various sources.
- **Personal development, health and physical education (PDHPE).** In PDHPE the focus is on treating others with respect, integrity, fairness and compassion. The ethical understanding that is being promoted is the value of diversity and equality for all in an interconnected world. In PDHPE, students explore fair play, equitable participation, empathy and respect in relationships. The curriculum provides opportunities for students to develop skills to make ethical decisions and understand the consequences of their actions. Through dilemmas and scenario-based learning, teachers are able to develop the capacity to apply these skills in everyday situations. This KLA focuses on relationships at home, in the community, in teams, in the natural environment and when using digital technologies such as social media and how we make ethical decisions within all of these areas.
- **Human society and its environment (HSIE).** In HSIE, students develop ethical understanding as they investigate current geographical and historical issues and evaluate their findings. They investigate the decisions that have been made historically and can determine if these were ethical. HSIE offers a range of ethical concepts for students to explore, such as human rights and citizenship.



Within this KLA, students have the opportunity to discuss personal and social responsibilities and the consequences of these decisions. This subject is a rich area where students can develop informed values and increase their awareness of the role that they play in being ethical and responsible citizens.

- **Science and technology.** Within science and technology, the science component offers students the opportunity to develop the capacity to form and make ethical judgements and consider the implications of their investigations on others and the environment. This KLA investigates a range of social, environmental and personal issues where students can make informed ethical decisions about topics such as the treatment of animals. The technologies component allows students to develop the capacity to understand and apply ethical principles when sharing and using technologies.

This KLA provides an opportunity to consider the rights of others and their responsibilities in terms of sustainability and protecting the planet and its life forms. A large part of ethical citizenship is understanding roles and responsibilities as citizens, and the part our young people play in social and natural systems. Science and technology also provides the opportunity to learn how to detect bias and inaccuracies within information, and to investigate how to protect data and individual privacy. These will be key qualities in a world with artificial intelligence.

- **Creative arts.** In the arts, students interact with artworks that may require ethical consideration. Students consider the artist's interpretation and their own interpretation of art. Students may consider how life experiences influence people's decision-making.

**Do you think most teachers feel confident teaching ethical understanding? What are some of the barriers that might prevent teachers from embedding ethical understanding into their programs? What supports might teachers need to teach ethical understanding effectively?**

No, I don't think that teachers feel confident in teaching ethical understanding right now. There's certainly some great work out there, of course. One of the closest things that I've seen is project-based learning, where schools might look at a real-world problem with an ethical dimension. Last year, for example, our students worked on a project where we linked with a school in Papua New Guinea. The students there were working by kerosene lamps – which were making the children sick. Our students created solar lights to send to their peers in the Papua New Guinean school. So, we were talking about countries that are energy poor, and our students developed an ethical solution that was driven by empathy and equity. I think our students, if you were to talk to them, would definitely have gained some level of ethical understanding out of that project-based learning unit, as well as developing deeper content knowledge in the key learning areas of English, science and geography.

But after my time with the Catalyst Lab, and after developing a better appreciation of ethical understanding, I would now approach that task a little bit differently. I'd focus more on asking students about the reasoning behind their decisions, and exploring the consequences of action and inaction more. So digging that little bit deeper to better develop students' capabilities to make – and articulate – well-reasoned, ethical decisions.

During my time working with the Catalyst Lab my team completed research and expert interviews on the challenge of developing students' ethical understanding skills. We found that what students needed, in order to become ethical citizens, was to think and reason in a different way, and that teachers needed more guidance to help them to plan, deliver and reflect on ethical concepts through syllabus content in an effective and time-saving manner. 100 per cent of teachers interviewed at the time had not even seen the ACARA Ethical Understanding learning continuum, let alone considered how they might integrate it into their programs and lessons. Our testing in a variety of schools proved that, broadly speaking, all teachers want a solution that integrates seamlessly into their teaching and learning cycle, so that ethical understanding becomes more of a priority in teaching and learning programs, and an opportunity to enrich content and learning experiences.

So what do teachers need? I think teachers need time and space to have a look at syllabus outcomes and the Ethical Understanding learning continuum developed by ACARA. They also need some professional learning around ethical understanding, so that they can generate their own understanding of it before they try to embed it within the curriculum. I think it's left to chance at the moment. Let's not leave it to chance. Let's actually have a look at how we embed it into our programs, and provide teachers with some support and professional learning around that.

### What are some approaches that can be used to develop students' ethical decision-making capabilities?

I think, first of all, that teachers need to have an understanding of where ethical understanding sits within the syllabus outcomes. My first recommendation is that teachers start to pull apart the outcome and develop a true understanding of what it is that they are really trying to achieve. Most teachers have an understanding of the general capability coding within the syllabus but have not really looked at the outcome and asked themselves, "what general capability am I trying to develop and what is the best way to do that?" Teachers are more focused on the KLA and its outcome, yet the coded capability would support achieving the KLA outcome in a more thorough and integrated manner.

The ACARA Ethical Understanding learning continuum outlines the learning within eight sub-elements needed to develop understanding across the three elements of:

- Understanding ethical concepts and issues
- Reasoning in decision making and actions
- Exploring values, rights and responsibilities

I recommend that teachers develop awareness of ACARA's Ethical Understanding learning continuum, and how they might integrate it into their teaching and programming.

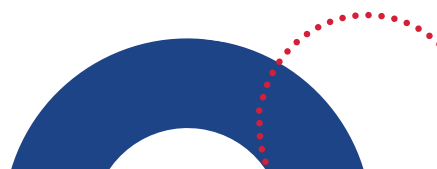
The Australian Curriculum, Assessment and Reporting Authority (ACARA) has developed learning continua for each of the seven general capabilities, including ethical understanding. These are available to download from [the Australian Curriculum website](#).



Through the work within the Catalyst Lab, we found that James Rest's 1986 Four-Component Model of moral development provides a strong foundation for thinking about and developing ethical understanding. It describes the cognitive processes individuals use in ethical decision-making and is an essential tool for developing ethical thinking with our students. We have used the Rest Model combined with the ethical understanding learning continuum to develop a questioning scaffold. Through this scaffold, joint understandings can be formulated where students move beyond ethical awareness to higher-order ethical reasoning. This questioning model ensures that we promote social discourse for our students in making ethical decisions and considering consequences.

I also promote the use of Talk Tools, which facilitate the important social discourse that creates shared meaning. Students need relatable and contextual narratives to discuss ethical issues and plan ethical actions. One talk tool that comes to mind is Town Hall, where students sit in an inner and outer circle. The students in the inner circle talk about the issue or dilemma. The students on the outer circle listen, and then when they wish to enter, they tap someone on the shoulder, that person stands up and they enter the inner circle and engage in that dialogue.

Scenario-based learning is another way of providing students with the opportunities for dialogue and questioning, where the building blocks for developing this way of learning can occur.



The Community of Inquiry Model is another learning framework that integrates three critical components – the teaching presence, social presence, and cognitive presence – to create curriculum integrated educational experiences that support students' development of ethical understanding. By applying a sequence of thinking skills heavily embedded in dialogue and questions focusing on ethical understanding, students develop an increasingly sophisticated understanding of the processes they can use whenever they encounter problems, unfamiliar information and new ideas.

**During the past few months schools have responded innovatively to the challenges brought on by COVID-19, including quickly implementing learning from home. From your experience in the Catalyst Lab Innovation Program, what advice would you give to schools and teachers looking to develop innovative solutions in an uncertain time?**

My advice for schools looking to innovate has a few key parts:

- First, narrow the focus and ensure that there is clarity on what is to be achieved: in other words, develop a common purpose, an agreement about the problem you're trying to solve and the common goal you're trying to achieve.

**Recognise that true learning occurs when we push ourselves outside of our comfort zones.**

- Second, be sure to listen to all team members and all ideas as there may be many untapped sources where you'll find the best solutions. During COVID-19, we found that inspiration for solutions sometimes came when it was least expected. Utilise the strengths and value the diverse life experiences of all team members. I learnt to empower my whole team, as you never really know where the next great idea may come from.
- Third, don't underestimate the need for human connection. When staff moved to working from home this created uncertainty, so we needed to find ways to stay closely connected. We learnt that innovative solutions require collaboration – people working together.
- Fourth, don't get too attached to any one plan or solution as things can and may need to change quickly. This was a key focus in our time with the Catalyst Lab where you needed to be prepared to let go of one idea or solution for potentially better ones. It was a lesson in the importance of flexibility and agile thinking.

- And finally, recognise that true learning occurs when we push ourselves outside of our comfort zones. I've been reflecting on how effectively schools across New South Wales moved to the home learning platforms in such a short period of time, out of necessity and a collective willingness to do things a different way. I think there is a great lesson in this when working with students. Of course we want our students to succeed, but we might be potentially allowing them to sit within their comfort zone where success is more assured – but the real gold, the best learning opportunities, can lie when we push beyond this. It means creating safe-to-fail opportunities – it means letting students know that it's ok to reach higher, to try, even if they don't quite get it right – because learning from failure can be as important as success.

At Revesby Public school, we have developed a new meaning for the COVID-19 acronym to capture the values and learnings of this time:

- C Connection.** How do we stay truly connected? How do we communicate, collaborate and maximise our collective work as a team?
- O Opportunities.** What is the new learning here and how can we benefit from this? What are the opportunities that are being offered to us in this situation?

- V Value.** What is it that we truly value? What are non-negotiables? We value wellbeing and maintaining education.
- I Influence.** What is within our area of influence? Reframing the way we see things as 'I get to'. I get to learn remotely. I get to work with exceptional people. I get to lead a classroom. I get to lead an amazing team. I get to maintain work. I get to support a family in need. This is really about the mindset that we bring to the table and how we show up.
- D Development.** How did we develop from this? How do we as parents and students learn from this? How did we develop as learners, teachers, administrators, how did we use technology differently? How did we evolve?
- 19** Think of 19 reasons to be grateful, as there is always something to be grateful for.

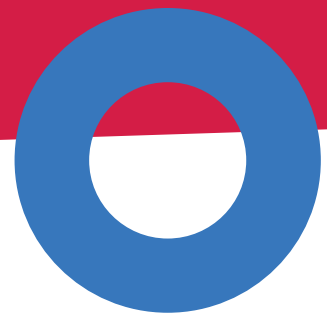
So my advice in a time of COVID-19 is: let's look to truly connect with each other, look for opportunities, remember what we truly value, think about the ways we can influence positively, change our talk to 'I get to' and focus on all of the development that this time brings us.





# Agency and ethics in a complex world

Catherine Stinson



The promise of artificial intelligence (AI) to transform both how we think about ourselves and how we live our lives has remained in the realm of science fiction for centuries, since at least as far back as Mary Shelley's 'Frankenstein'. Only recently has AI rather suddenly started to deliver on that promise. Robots are caring for the elderly. Self-driving cars are on the roads. Elections have been won and lost due to AI personality profiling. Warehouse workers are being promoted and fired by autonomous algorithms.

A moment of reckoning is happening in the technology sector. Researchers and coders are realising that their jobs are not purely technical in nature. Governments and corporations are grappling with the social and ethical impacts of AI. Regular people are waking up to the hidden effects technology is having on their lives. This article projects into the not-so-distant future to explore the societal changes AI is bringing, and suggests some ways that education systems might adapt in the face of these changes. Students will need new skills

and capacities to thrive in an AI future, and to steer AI in directions they may find more desirable.

## Introduction

While we can't predict all of the effects that AI will have in the coming years, some likely scenarios are apparent enough that we can begin planning how education systems ought to change in order to prepare society for a future with AI. Three areas where changes to education systems are called for are digital literacy, social responsibility, and the world of work.



1. **Digital literacy:** The distinction between being offline and online is blurring as our private lives become saturated with technology. Digital literacy needs to evolve beyond knowing how to use a word processor and not divulging personal information to strangers, to include new skills like navigating ubiquitous surveillance, interacting with AI agents and being able to identify deep fakes.
  2. **Social responsibility:** One by one, fields have come to realise that their work has social implications. Tertiary education has responded by introducing applied ethics training in engineering, medicine, science, business, and now computer science. It is time to consider ethical reasoning as a key component of education at all levels.
  3. **The world of work:** Employment conditions are changing rapidly. Gig work is becoming more common, the world is increasingly globalised, and further automation across many sectors is expected in the coming years. Instead of preparing students for today's jobs, education systems need to prepare students for a world where these jobs may not exist.
- These three areas do not exhaust the changes to education that will be needed to prepare for a future where AI is ubiquitous. Some areas not discussed here are the technical training that will be needed for future AI workers, as well as workers in areas like medicine which are increasingly making use of AI technology. Another area only discussed in passing is how education in political science and economics will need to adapt.

These areas may be expected to shift more organically, rather than requiring major overhauls.

As a way of illustrating the need for changes to educational approaches to digital literacy, social responsibility and the world of work, I have included a series of future scenarios in this article. These scenarios focus on privacy, governance and automation: they are my attempt to show how appropriate educational responses now can lead to positive social outcomes and, conversely, how our failure to respond to current technological trends could mean a bleak future. They are also intended to illustrate that technology is only as powerful as we allow it to be. The pace of technological change is not unstoppable, and much-discussed singularity scenarios (where AI becomes more intelligent than humans, and disaster follows) are not inevitable (Luckerson, 2014).

Though imagined, the future scenarios I propose throughout this article are not so distant and they are grounded in trends that are happening now. First, it's important to understand what some of these current trends are.

### **Current trends driven by AI and other emerging technologies**

Alongside the benefits that AI is already bringing to fields as diverse as education, health, transport, manufacturing and agriculture, we are also seeing some of the more worrying implications of increasingly advanced technologies.

Particularly concerning are the erosion of individual privacy, commercialisation of democratic systems, and impacts on labour markets and work.

### **The erosion of privacy**

When you're in a major city, it's hard to escape the gaze of surveillance cameras. In northwest China, for example, Uighur Muslims are surveilled constantly through tracking software in cell phones, ID checkpoints and video cameras (Byler, 2019). A Google affiliate company proposed to build a prototype 'smart' neighbourhood in Toronto, featuring cameras in doorbells and garbage cans (Barth, 2018). Police forces are already using facial recognition software (Bowcott, 2018), and may soon also use technologies to recognise unique heartbeats (Pickrell, 2019), and gait (Giles, 2012) to identify individuals gathered in public spaces, or driving past strategic points like bridges (Collier, 2017).

The public is participating in this surveillance by taking video of altercations they witness, and publicly identifying and shaming perceived wrongdoers. Landlords have been caught hiding cameras in rental units (Paluska, 2017), and families are spying on one another with nanny cams. Soon, being out in public will likely mean being on camera continually. Meanwhile, adversaries can do serious harm to your reputation by slightly slowing down a video or manipulating an image of you (Harwell, 2019).

Cell phones, fitness gadgets, navigation systems and key finders like Tile are tracking the locations and activities of technology users (Associated Press, 2018). Although some cities like San Francisco are banning the use of facial recognition software by police and city agencies (Conger et al., 2019), the use of this software by governments and corporations is expanding rapidly. With electronic payments now the norm and companies building sophisticated user profiles, systems which enable widespread real-time surveillance of individuals are largely already in place.

### The commercialisation of democracy

The profits of the biggest tech companies already exceed the GDP of most countries (Myers, 2016), giving them power to not only influence regulation and governance on a global scale, but also deeply affect living conditions (McCabe, 2016). This is now apparent in how tech companies alter housing markets (Barr, 2019), transport infrastructure (Gumbel, 2014), and working conditions in the cities where they operate in ways that affect entire regions.

Tech companies are getting into the business of providing community healthcare services, public health monitoring (Gelfand, 2019), email and web servers for governments and universities, transport planning, education delivery and curriculum design (Singer, 2017). AI has already shifted public opinion in several

political elections, with global effects, and its power to control public opinion will only grow. The EU's General Data Protection Regulation is one measure to regulate the industry. Yet outside the EU, AI companies are defying national governments by refusing to comply with local privacy laws (Office of the Privacy Commissioner of Canada, 2019), and simply paying fines that are too small to affect their profits.

### Impacts on work and the labour market

The taskification of work, where jobs get broken down into ever smaller tasks, is apparent across the gig economy. This translates to lower pay for workers who no longer need broad skill sets, and fewer paid hours of work, since transition time between tasks is cut out. It is likely that this trend will make many jobs much more specialised and narrow. Tech jobs in particular are becoming increasingly stratified. Tech support has already moved to markets where wages are low and worker protections weak. Many programming jobs have been downgraded to temporary gig work (Clarke, 2018), and tasks like data labelling are being done for extremely low pay through hubs like Mechanical Turk, or in sweatshop conditions in the global south (Gray & Suri, 2017; LeVine & Waddell, 2019; Vengattil & Dave, 2019).

Power over how AI technology develops is becoming concentrated in a few hands, hampering the ability of users, tech workers and

governments to regulate the industry. Meanwhile, AI and automation are significantly impacting job markets across a range of other sectors, including customer service, care work, manufacturing and transport.

## Education's crucial role in shaping the AI future

Education at all levels will determine where we go from here as a society, but I want to focus on what secondary education can do to prepare students for the future of AI – particularly on the importance of digital literacy, social responsibility, and preparing students to live in an AI world.

### Digital literacy

Traditionally, digital literacy education consisted of experience using popular applications like word processors, spreadsheets, presentation tools and sometimes more specialised software like video editing or design suites. Training in coding skills and website creation is becoming more commonplace. In addition, students typically get training in how to stay safe online by being careful of sharing personal information with strangers, avoiding phishing scams and malware, and responding effectively to online bullying. All of these are useful lessons, but only scratch the surface of what people need to know to thrive in an AI world.

General familiarity with AI and data analysis techniques is one key area where secondary education could be beneficial. The common

perception that AI is mysterious and incomprehensible needs to be challenged. Without requiring any advanced mathematics or knowledge of the details of complex algorithms, the basic idea of how AI algorithms work can be communicated. For example, the k-means algorithm (which identifies patterns in data to create data clusters) could be illustrated by getting students to organise themselves into groups by height. First, each student randomly chooses a group to join, then the groups iteratively make corrections by moving the tallest or shortest person to an adjacent group, until no further corrections are needed. Collaborative filtering could be illustrated by asking a series of questions about which movies the students like. With each question, students who answer the same way stay together, and those who answer differently branch off into a new group. After a few divisions, the students can make predictions about what other movies the people in their group will like based on their own preferences. The main points to get across are that these algorithms are in essence very simple, but that with enough data and computing power they can make very accurate and detailed predictions and classifications.

The next step is awareness of just how much data is being gathered about us, and what that data is being used for. It used to be that to protect your privacy online you ought not to reveal things like social security numbers, home addresses or compromising



pictures. In the past few years, many people learned the hard way that answering questions about which 80s TV character you're most like, or which breed of dog you are can be just as dangerous (Bisceglia, 2017). These quizzes have been used to build detailed personality profiles, in order to manipulate people's beliefs and behaviours (Cadwalladr, 2018). Likewise, commercial DNA sequencing services marketed as ways of finding unknown relatives or discovering your heritage have very broad terms of service that allow them to share and sell sensitive personal information (Brodwin, 2018), and make troubling partnerships with law enforcement (Brown, 2019). Similarly, apps that match your face to famous paintings (Held, 2018), or filter your face to look like a baby (Pathak, 2019) are almost certainly being used to build facial recognition databases, which will likely end up being used for surveillance. Protecting your privacy

online now requires a lot more savvy about what apparently benign apps are doing behind the scenes.

Privacy policies are often oppressively long and technical to read, but students can learn some of the basic vocabulary needed to understand them (Stinson, 2018), and practice scanning these documents for suspicious content. Navigating the privacy settings of common applications like Google is also a learnable skill. Having students research the companies that make their favourite software can help them develop an awareness of how data is being used. Who are the board members? What political contributions have they made? What other companies are they involved with? What patents have they filed? Similar exercises can be done with political memes. Are they being disseminated by bots? Where did they originate from, and can the claims in them be fact checked?

**Another component that would improve digital literacy education is knowing what can be done to push back when technology companies behave unethically, and when it's important to do so.**

Another component that would improve digital literacy education is knowing what can be done to push back when technology companies behave unethically, and when it's important to do so. Knowledge of privacy and consent protections has long been the near exclusive domain of legal scholars, but this knowledge needs to go mainstream. People should know that when stores ask for your email address at the checkout, you can refuse; when a club or service asks for demographic information as part of their registration process, they have no legal basis for requiring it; and that they need your consent to use that data for any additional purposes.

Being put on a department store's mailing list may seem like a minor inconvenience, but in the age of AI, giving away apparently insignificant data can have significant consequences. It is not difficult to correlate purchase behaviours with personal information like pregnancy status, health problems, age and political beliefs. Since email addresses are used as website logins, they can be used to track online behaviour,

and connect people to locations and social networks. All told, that's a lot of powerful information to give a store in exchange for a coupon.

Students could also benefit from learning more about the history of technology, and the history of business regulation and workers' rights. They could be introduced to case studies illustrating how technology changes society, often in unanticipated ways, and to the common patterns that technological disruptions tend to follow.

Finally, as AI becomes more interactive, we need to know how to speak to it. It may seem harmless to swear in frustration at self-checkout machines when they malfunction, but as these tools become more human-like, the social and ethical implications become concerning. Already people are noting how disturbing it is that small children shout abuse at personal assistants like Alexa (Truong, 2016), which are so often coded as feminine (Lafrance, 2016). Just as children used to be taught how to make polite phone calls, they should be taught to interact respectfully with AI personal assistants.

Education in digital literacy can go a long way to determining whether we actively create an empowered populace or allow the end of privacy in our society. The scenarios on pages 66-67 present two alternative future states, with effective education (or lack of it) being the key factor in determining which we live out.





## 1. Future scenarios: an empowered populace or the end of privacy

### **An empowered populace**

Young people are cluing in to the fact that having 'nothing to hide' does not keep them safe from ubiquitous surveillance. Location tracking and harvesting of personal data for uses the public neither knows about nor consents to is being uncovered and shut down. There is also powerful pushback against facial recognition technology, with widespread national bans and regulation of its use in public spaces. It is becoming so taboo that no company wants to risk getting caught using facial recognition software in public, and countries that continue to use it are liable to be sanctioned for human rights abuses.

Anger is growing over products that are clearly designed for cyberstalking. Cybersecurity experts are disseminating tools to disable these apps, and spreading awareness about them. The public's digital literacy and awareness of privacy rights has ensured that a high profile case in which this technology was implicated in violence is being followed up with stricter regulation.

Another area where pushback has grown is against overly permissive privacy policies and terms of service agreements online. People are increasingly aware that they need to look closely at the policies in place for the apps they use, and are gaining the tech savvy to either turn off settings that permit rights violations, or choosing to sign off from the offending services.

As consumers demand apps that do not track them, harvest their personal data or bombard them with advertising, competition is forcing developers to change their business models. More and more platforms are being developed that are premised on personal control of data, or cooperative data governance through local data trusts which ensure that AI's uses benefit the public. This is, in turn, increasing the public's trust in technology so that they feel safe and comfortable freely sharing data for select purposes like evidence-based medical and public policy research.

## The end of privacy

The use of facial recognition software has continued to expand rapidly, allowing anyone with a camera to identify individuals, as long as they have access to identity databases – but those databases are not accessible to all. Governments have databases of faces linked to identities from driver licences and passports, and AI companies are building databases from photo apps and social media tags. Many governments and corporations are tracking individuals' locations and activities in real-time.

Criminal and other undesirable activities are instantly detected and dealt with by automatically deducting fines for illegal parking, or apprehending would-be criminals before they act. Which activities are punished depend on the priorities of police forces, governments and AI companies, and these systems are susceptible to interference by the powerful. Facial recognition software continues to work unreliably for marginalised groups. Cases of mistaken identity occur frequently, and since the systems lack transparency, it is difficult to

prove one's innocence without access to surveillance data controlled by police, governments, and corporations. Deep fakes frame people for crimes they didn't commit.

Personalised advertising invades our space, popping up on all of the screens we encounter, through ear buds, on wearables, and via personal assistants like Alexa. The only way to opt out of ubiquitous advertising is to pay monthly subscription fees, but the more subtle behaviour modification nudges are so sophisticated as to go unnoticed. The feeling of being constantly monitored has eroded public trust to the point where people do not feel comfortable going out in public, creating social isolation and furthering dependence on social media and interactions with AI.

## Social responsibility

The revelation that Cambridge Analytica's AI-driven personality profiling may have influenced both the Brexit referendum and 2016 US Presidential election, and the looming possibility that self-driving cars will soon be commonplace has provoked a moral reckoning in AI. There has been a shift in the field toward recognising that technological innovations have social and ethical implications, contrary to the previously popular view that algorithms are politically and ethically neutral. While this realisation has come late to many people working in AI, researchers in science and technology studies have been raising alarm bells about AI's potential harm for decades.

The need for ethical oversight of AI is now a hot topic. Some of the proposed oversight measures, like codes of ethics for the field, or ethics officers within tech companies, have been criticised for how ineffectual they're likely to be. Other suggestions – requiring applied ethics courses in post-secondary computer science education, as well as more attention to the social and ethical implications of technology throughout the curriculum – may be more effective as long as they're done well. More ethics training in secondary education would be highly beneficial, both so that the message is not delivered too late to be absorbed, and so that it reaches as broad an audience as possible.

AI is only the most recent field to have its moment of reckoning. Physics had its moment during the Manhattan project. Biology has faced ethical issues over cloning and genetic engineering. Engineering has long recognised that skyscrapers and bridges need to be built with public safety top of mind. Medicine had its moment during the Nuremberg trials. Business ethics training picked up around the time of the Enron scandal. What all of this illustrates is that education in ethical reasoning is essential in most every field of human endeavour.

Common reasons why including ethical education in public schools can be controversial include the conviction that values ought to be taught in the home or places of worship, and a belief in moral relativism – that there are no universal human values. With most parents now working full-time and fewer people participating in organised religion, formal ethical education isn't always happening in those other spaces. Although there are certainly areas of disagreement on values across cultures and religions, there is a lot of common ground too. Kindergarten classes already teach universal rules like sharing and keeping one's hands to oneself.

Pedagogical research shows that the most effective applied ethics classes teach ethical theory embedded within realistic examples taken from the relevant field, where students are given ample opportunities for discussion and reflection, and time

interacting with teachers (Schmidt et al., 2009). Medical ethics classes might illustrate the difference between utilitarian and Kantian ethics using a case study where the benefits and harms to a pregnant person and their foetus are at odds. Business ethics classes might teach similar theoretical content using a case study about oil exploration, where the interests of shareholders and the public are at odds. In such cases, disagreements about values are likely to remain deeply entrenched, but students can develop ethical reasoning skills by breaking down the problem to make clear what all the competing interests are, and by defending their choices about which actions are best, based on a careful consideration of those competing interests. Decades of pedagogical research confirm that ethical reasoning and empathy can be taught (Riess, 2015).

Ethical reasoning skills are not just an end in themselves. In medicine, higher scores on measures of moral reasoning and empathy correlate with higher patient satisfaction and adherence to therapy, decreased medical errors and malpractice claims, and better health outcomes (Hall et al., 1988; Riess et al., 2012). In business, customer and employee loyalty increase when a company is perceived as behaving ethically, which increases profits and reduces staffing costs (Schmidt et al., 2009). Not only are there compelling reasons for teaching ethics, students would benefit from knowing that social responsibility is good for business,

in order to counteract the popular view in business and tech circles that the way to get ahead is to be ruthless and break things.

Another proposed corrective to AI's ethical crisis is increasing the diversity of the workforce. However, it is not always made clear how exactly more diversity is supposed to make AI more ethical. It could be that diversity is seen as a good in itself. It could be that diversity hires are meant to protect the interests of the underrepresented groups to which the people hired belong. A more nuanced set of arguments coming from work in standpoint epistemology suggests that groups of scientists are more likely to achieve objectivity if the group includes members of marginalised communities, because those individuals are in a better position to notice assumptions that are taken for granted by insiders (Haraway, 1988). Others argue that it is the functional diversity of scientific teams that matters for high performance, rather than inclusion of members occupying marginalised positions (Hong & Page, 2004; Longino, 1994). These may come to much the same thing, as increasing diversity in teams tends to mean including members of marginalised communities.

This sort of message of inclusivity and diversity is already part of liberal education, but could be strengthened in several ways – including by modelling diversity practices in the hiring of teachers, principals and other school staff. Perhaps the most powerful way of diversifying

**One of the most pressing reasons for including more ethical reasoning education in secondary schooling – especially embedded within science and technology classes – is that technology is becoming more autonomous**

the future composition of the AI workforce could be to overcome stereotypes about maths and computer science (Cheryan et al., 2013), and to train students in how to challenge status quo assumptions. Programs that teach girls to code have largely been unsuccessful in increasing the number of women in the field, not because of a lack of girls' interest in technology but because the pipeline leaks at later points (Leslie et al., 2015; Wang & Degol, 2017). When those girls enter the workforce, they can face stereotype threat, discrimination and harassment, which lead to attrition. Targeted skill building programs aren't effective if they're not paired with tools for cultural change.

One of the most pressing reasons for including more ethical reasoning education in secondary schooling – especially embedded within science and technology classes – is that technology is becoming more autonomous. It used to be that computer programs had users running them, with the user making decisions about what actions to take with the guidance of the program.

There is a shift happening where the human user is being removed from the equation and programs are making autonomous decisions about which actions to take, then implementing them directly without oversight.

A problem that gets a lot more research and media attention is whether we'll be able to design ethical machines, and how to do so. The problem being faced right now is that we're allowing machines to make decisions of ethical import without even trying to build ethical decision-making abilities into them. It used to be less important for computer scientists to know ethics, because their programs had human users who could take responsibility for decisions, but that abdication of responsibility is not acceptable when there is no human user. This means that the people building technology need to follow a very different design process: one that considers ethical questions about social impact from the earliest stages. For that new kind of design process to sink in, we need to start much earlier, and invest much more effort than offering a single applied ethics course in university programs.

The scenarios on the next page show how effective ethical reasoning education could support more empowered governments, while a failure to teach ethical reasoning could lead to the further commercialisation of democracy.

## 2. Future scenarios: empowered governments or the commercialisation of democracy

### Empowered governments

Tech companies continue to have influence over policy, but the tide is turning thanks to young people with digital literacy skills and a sense of social responsibility. They have an appreciation for business ethics and are not intimidated by tech speak. Although continued effort is needed to keep regulation from lagging behind, the tech giants are largely being reined in, returning political decision-making as well as tax revenues to governments.

The human costs of automation are carefully considered in decisions about whether to invest in AI, which has slowed its adoption long enough for regulation to catch up. Pushback against austerity measures is returning the provision of social services to the public sector, and continuing the global move toward stronger public education, health and mass transit systems. Attempts by tech companies to get into the business of controlling infrastructure in major cities by setting up smart city pilots have been shut down by social action.

### The commercialisation of democracy

Government revenues are being impacted by globalisation and wealth is concentrated in a few large companies, who find creative ways of avoiding taxation. Without tax revenue, governments are becoming less able to compete with tech companies in their ability to govern. This has led to the offloading of essential services to corporations, with governments relinquishing control over how these services are provided and where the data goes. These same corporations also spend massive amounts of

money lobbying governments and funding candidates' campaigns.

The next step could well be corporate ownership of governments, and public services like education and healthcare only being available via paid subscriptions to institutions like the Amazon White House, or the Parliament of Australia: powered by Moodle. Some commentators have been predicting this logical progression for a while; but their warnings have been largely unheeded, and now it seems too late to stop it.




## Preparing for life in an AI world

Schools always play a balancing act, where the pressure to prepare students for jobs or careers competes with the responsibility to develop well-rounded people. In recent years, many school systems have shifted the balance toward spending more time on career readiness skills and less time on things like physical play and the arts. As we transition to economies where many jobs are being automated, this balance may need to be re-adjusted. There is some disagreement and uncertainty over which types of jobs will disappear, which will remain, and which will be created. There may be far fewer jobs, far more people, yet enough resources to support the population in the medium term (dependent of course on how climate change plays out).

One way that secondary education can adapt to the changing world of work is to prepare students for the jobs that are most likely to continue to exist and to be created. Some of the types of jobs expected to remain are technical jobs like writing, debugging and testing code, designing and repairing machinery, maintaining data privacy and security, doing entrepreneurial work like developing new product ideas, and in general jobs that require problem solving and creative thinking skills. As mentioned already, an additional layer to these jobs will be the necessity to consider the ethical and social impacts of new technologies. Whether care work like nursing, childcare and talk therapy remain the domain of human workers or are automated is hard to predict. Elder care is starting to be done by robots in some places,







but regulation of some care work industries may block their expansion to other domains.

It seems likely that new jobs will be created for people who are both technically competent and trained in fields like sociology or philosophy, so as to act as ethics and social impact advisers within tech companies. In the near term, there will be a need for teachers to re-train current tech workers who did not receive this kind of training in school, and to develop school curriculum and adult education programs for this training. AI ethics programs are already cropping up in universities.

There is also reason to believe that interdisciplinarity will be particularly valued in jobs of the future. The need for people with both technical and sociological or ethical expertise is just one example. In fields like medicine and education, greater digital literacy will be needed as high tech treatments and educational tools become more common, requiring doctors, nurses and teachers to be better trained in the use of technology. Likewise, it may be useful to have employees who are more versatile and flexible so that they can do many kinds of work, depending on what needs to be done. Generalists could therefore become particularly valuable. Recent evidence also suggests that generalists are better at predicting future outcomes than specialists (Epstein, 2019), which may be an important skill in a world where change seems to be accelerating.

A common prediction about the future of work is that the jobs that will survive will be ones that require creativity and imagination, because these are skills that have proven difficult to automate. While deep learning has created programs that can mimic the artistic styles of famous painters, and write (slightly odd) screenplays, coming up with truly new ideas is still a characteristically human skill. To prepare for this, regular art and music classes remain invaluable, as well as the addition of creativity training within other disciplines. A biology class on evolution, for example, might include an exercise where students imagine which types of animals and plants might evolve in a fictional environment, or design new hybrid organisms.

Critical thinking is another set of skills projected to increase in importance in coming years. While logical reasoning is easy for computers, the fuzzier skills that make up common sense are more difficult to automate. Picking out the meaning in an allegory or poem, recognising sarcasm, seeing what is missing or out of place in a picture, and figuring out which information is relevant to a given context are all examples of critical thinking skills at which humans excel, but computers do not. Critical thinking could be taught in combination with digital literacy. Evaluating whether a social media account is spreading propaganda, for example, includes elements of both.



As work changes, and lifelong learning becomes commonplace, it might also make sense to better integrate education with work so that student/workers can move more seamlessly back and forth between learning and doing. Instead of having students do major projects that end as a report that only their teacher reads, teachers could be encouraged to give assignments that have real-world impact. Governments and businesses could be encouraged to have their employees work on projects in collaboration with teachers and students.

Another consideration for educators is the benefit of assessing students with a focus on quality rather than speed or quantity. The sorts of tasks where speed is valued will likely be the ones that there is economic pressure to automate, while deep thinking and creativity can't be rushed. If that deeper thinking is what remains for humans to contribute, it ought to be encouraged in students.

In the scenarios on the next page, I explore how developing young people's thinking skills in the classroom can support them to become empowered workers. Without high-quality education in thinking skills, young people may instead experience a world of widespread unemployment.

### 3. Future scenarios: an empowered workforce or widespread unemployment

#### **An empowered workforce**

The move to automation of jobs has been carefully managed, with guaranteed income programs, pensions for laid off workers and extended subsidised leave for parenting, elder care and re-training. Working hours have been reduced where necessary so that most people who are able to work remain in the workforce. Businesses have discovered that for the work that is best done by humans, it is more cost effective to shorten working hours and allow flexible leave, because the quality of the work more than makes up for the decrease in working hours. Work hours are concentrated bursts of highly motivated, efficient work with very few errors.

As well as greater efficiency, results include better preventative health care and reduced stress – leading to decreased costs across sectors including Health, Aged Care and Justice. This has enabled investments in social programs to cover subsidised leave and guaranteed incomes. Because of these programs the balance of power has shifted to workers, who no longer feel pressured to stay in exploitative jobs. People find fulfilment from contributing high quality work, creative expression, and in making human connections – which has also led to less dependence on social media interactions and AI personal assistants.

#### **Widespread unemployment**

Unemployment has risen above 50%, as AI and automation decimates job markets in sectors like customer service, care work, education, transportation and manufacturing. Those workers who have kept their jobs are subject to increasingly tight control by their employers, because the automation

of jobs has rolled out in a way that profits are concentrated in a few hands. Without work, many people have nothing better to do than spend hours playing video games and surfing social media. These apps are highly addictive, and monetary incentives to stay online and keep engaging are woven into the experience.

## Conclusions

The concentrated power of the big tech companies and lack of regulation makes for an ominous situation, where change is sorely needed. Current trends suggest that we're headed for a world of ubiquitous surveillance, where facial recognition software is widely used to track activities and authenticate identities, largely for the purpose of manipulation and marketing. It's also a world where tech companies are encroaching into governance and delivery of essential services, and the world of work is moving toward widespread unemployment and disenfranchisement.

These trends need not continue unchecked, however – motivated public servants and an educated public have the capacity to change our current trajectory. In addition to tighter regulation, the young people of today can be given the skills and knowledge to hold tech giants to account. With expanded digital literacy training, students can gain facility with AI algorithms, and the legalese in terms of service agreements. They can learn how to protect their personal information, how to spot fake news and attempts at manipulation, and how to push back when their labour is being exploited.

Both young and old will need to change their expectations about work to prepare for automation's shake up of the world of work. Teaching interdisciplinarity, creativity, and the value of careful, high quality work is the best way of preparing students for the future of work. They will need to be prepared to find fulfilment outside of their careers, since available working hours may be reduced.

We can redirect AI toward a future where data is given consensually to be used in evidence-based decision-making toward goals that the public values, such as the real-time tracking and management of contagious diseases; a future where tech companies are less powerful and contribute tax revenues and pensions to subsidise minimum incomes, and where fewer working hours are used more efficiently.

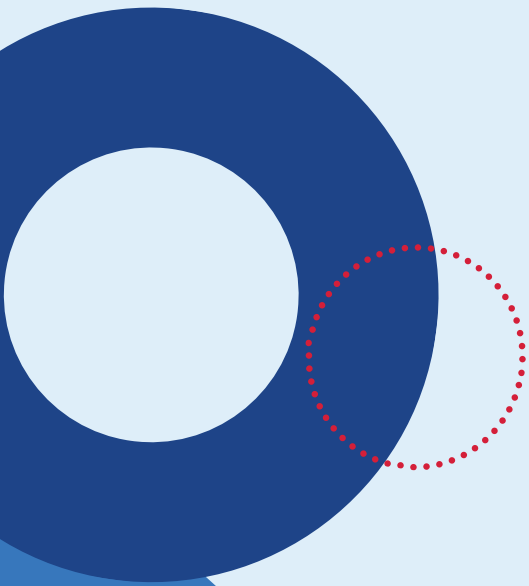
The next generation of tech workers can be taught mature ethical reasoning skills and a sense of social responsibility. If teachers model the diversity and allyship needed to enact cultural change in the tech world, today's students will spread that cultural change as they enter the workforce, bringing with them more diversity and more equitable outcomes.

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