Trends Shaping Education 2022

OECD

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Foreword

The COVID-19 pandemic has reminded us that, despite the best laid plans, the truth is that the future likes to surprise us. The scramble to close schools and shift to online education as COVID-19 spread across the globe was a natural reaction to a crisis, and there are innumerable examples of individuals going above and beyond to ensure the continuity of education even in the most remote regions.

But it was also a warning. As the pandemic (hopefully) moves into the background, we are still faced with a future in which shocks and surprises – whether due to increasing numbers of extreme weather events, disruptive technology, or other sources, including new pandemics – are only expected to increase. Preparing for both expected and unexpected futures is no longer an optional "nice to have". It allows us to act now to future-proof our education systems, and stress test them against potential shocks.

Trends Shaping Education 2022 is the sixth edition in a series designed to support long-term strategic thinking in education. It provides an overview of key economic, social, demographic and technological trends and raises pertinent questions about their impact on education. This book fills an important need: decision makers and practitioners in education often have only anecdotal or local information on the megatrends that play out in their context; too often they do not have solid facts in front of them, especially about trends.

The first edition of this book was published in 2008. This edition features new chapters on knowledge and power, identity and well-being and our changing nature. Each chapter starts with a spotlight on the disruption from COVID-19 before turning to the trends and potential implications for education. Each ends with a push to the medium-term future 10-15 years from now, linking to the OECD Scenarios for the Futures of Schooling and suggesting surprises and shocks that could disrupt our planning and, indeed, the trends themselves. As with the 2019 edition, digital technology is incorporated across all the chapters, just as it is now thoroughly embedded in our daily life.

The process of identifying and compiling relevant trends and data on such disparate subjects is necessarily collaborative, and this volume benefits enormously from the support and suggestions of a number of different individuals and institutions. The authors thank the Flemish Ministry of Education for consistently supporting this work since its inception. We would also like to thank the diverse set of multi-disciplinary experts who gave their time and insights in a series of virtual meetings: Arnstein Aassve, Miquel Angel Alegre, Beatrice Avalos, Jeroen Backs, Francisco Benavides, Marius Busemeyer, Queralt Capsada-Munsech, Eliana Chamizo, Kai-ming Cheng, Andreas Dammertz, Catrin Finkenauer, Roubini Gropas, Martin Henry, Tommi Himberg, Edith Hooge, Maciej Jacubowski, Siv Lindstrøm, Tatiana Matthiesen, Raya Muttarak, Amy Orben, Anu Realo, Dominic Regester, Claudia Sarrico, Sebastian Sattler, Tom Schuller, Cecilia Tacoli, Klaus Teichmann, Henno Theisens, Dirk Van Damme, Maarten Vollenbroek, Kristen Weatherby, Malak Zaalouk and Ainara Zubillaga.

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Table of contents

Foreword 3

Executive Summary 8

Global trends and the future of education 10
- What is Trends Shaping Education? 10
- Trends and future thinking 11

1 Growth 15
- Overview and impact of COVID-19 16
- Growing prosperity 18
- A new source of growth 20
- Demographic pressures 22
- A growth revolution? 24
- To infinity and beyond 26
- What future for growth and education? 28
- Find out more 30

2 Living and working 33
- Overview and impact of COVID-19 34
- Work to live or live to work? 36
- New employment for a new age? 38
- The quantification of life 40
- 21st century families 42
- Quality of life 44
- What future for living, working and education? 46
- Find out more 48

3 Knowledge and power 51
- Overview and impact of COVID-19 52
- Knowledge societies 54
- Artificial intelligence: Are the data too big to fail? 56
- Opening up science 58
- Knowledge governance 60
- Speaking truth to power 62
- What future for knowledge, power and education? 64
- Find out more 66

4 Identity and belonging 69

Overview and impact of COVID-19 70
You can go your own way 72
It's a small world after all 74
Speak your mind 76
All for one and one for all 78
The many profiles of us 80
What future for identity and belonging and education? 82
Find out more 84

5 Our changing nature 87

Overview and impact of COVID-19 88
There is no Planet B 90
The natural world 92
Food for thought 94
Our human body 96
No one lives in cyberspace 98
What future for our changing nature and education? 100
Find out more 102

FIGURES

Figure 1.1 Increasing affluence 18
Figure 1.2. Expanding population, shrinking extreme poverty 19
Figure 1.3. Intangible innovation 20
Figure 1.4. The rise of Big Tech 21
Figure 1.5. Growing grey 22
Figure 1.6. Productivity as an offset to an ageing population? 23
Figure 1.7. Got solar? 24
Figure 1.8. Fossil fuels are still king 25
Figure 1.9. Eyes in the sky 26
Figure 1.10. In space no one can see you litter 27
Figure 2.1. In pursuit of a work-life balance 36
Figure 2.2. Out of office 37
Figure 2.3. The age of precariousness 38
Figure 2.4. Digital Taylorism 39
Figure 2.5. An app a day keeps the doctor away? 40
Figure 2.6. Love at first swipe 41
Figure 2.7. Till death do us part 42
Figure 2.8. Man of the house? 43
Figure 2.9. Strangers in the night 44
Figure 2.10. How (un)affordable is your home? 45
Figure 3.1. An infinite library 54
Figure 3.2. The wisdom of crowds 55
Figure 3.3. Our world in data 56
Figure 3.4. The advent of smart machines? 57
Figure 3.5. Science is self-correcting 58
Figure 3.6. Full disclosure: The rise of open peer review 59
Figure 3.7. In need of expert knowledge 60
Figure 3.8. Government support for innovation 61
Figure 3.9. A public's right to know 62
Figure 3.10. A wave of deliberative politics 63
Figure 4.1. Are you a believer? 72
Figure 4.2. A worker's right to choose 73

Figure 4.3. Home, new home 74
Figure 4.4. We're all in this together 75
Figure 4.5. Get up, stand up 76
Figure 4.6. From the schoolyard to the ballot box 77
Figure 4.7. Pride and prejudice 78
Figure 4.8. Jumping hurdles: Sports and disability 79
Figure 4.9. I post, therefore I am 80
Figure 4.10. All the internet's a stage 81
Figure 5.1. An outsized ecological footprint 90
Figure 5.2. CO_2de red 91
Figure 5.3. Nature first 92
Figure 5.4. Urban jungles 93
Figure 5.5. Growing more with less 94
Figure 5.6. Would you like salt with that? 95
Figure 5.7. The art of medicine 96
Figure 5.8. Forever young: Augmented humanity 97
Figure 5.9. Where the (virtual) wild things are 98
Figure 5.10. A picture is worth a thousand words 99

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Executive Summary

The world is witnessing a growing disconnect between the economic growth imperative and our planet's finite resources; between the increased affluence of some and the well-being of many. Rapid technological change may not help pressing social needs, and despite rising connectivity, many feel lonely and voiceless.

Better education is often proposed as the solution to these diverse challenges. Examining the future of education in the context of major economic, political social and technological trends is necessary for education to support individuals to develop as persons, citizens and professionals. In a complex and quickly changing world, this might require rethinking the relationship between formal and informal learning and reimagining education content and delivery. In an increasingly digitalised world, these intertwined and evolving trends could affect the very nature of knowledge and learning itself.

Reflecting on the future of education does not mean simply pushing problems into the future. Rather, responsible policy-making pulls future developments into the present to learn and prepare. This book is meant to challenge, to inspire, and, most of all, to encourage readers to ask themselves: "What do global trends mean for the future of my education system? And what can we do?"

What is in this publication?

Trends Shaping Education 2022 explores megatrends affecting the future of education, from early childhood through to lifelong learning. Each chapter starts by examining the impact of COVID-19 before turning to the trends and their implications for education.

Chapter 1, **Growth**, shows how economic growth has lifted millions out of poverty and raised living standards worldwide. Yet despite increasing affluence, socio-economic inequalities are widening, and the unsustainable use of resources is straining our environment. As we increasingly search for new economic opportunities beyond our planet's borders, rising pressures such as rapidly ageing populations give added urgency to rethinking growth models to reconcile shared prosperity and sustainable life.

Education has traditionally benefitted economic growth by enabling social mobility and cultivating the competences necessary for individuals to participate in the economy. The provision of high-quality education, lifelong and life-wide, is key to the upskilling and reskilling needed for all citizens to contribute to society, no matter their age. It is also important in raising environmental awareness and developing the technical and critical thinking skills necessary for a sustainable future, both here on Earth and beyond.

Reconciling growth and sustainability also means changes to our working and private lives. **Chapter 2**, **Living and working**, highlights the steady reduction in working hours from a century ago, and the rise of flexible work, such as part-time or telework. Digital technologies increasingly help us manage our private life, from tracking our daily steps to organising our dating. At home, family structures continue evolving, with slow but steady steps towards gender equality. Still, ensuring safe communities and affordable housing remain challenges.

Education can help forge communities where all members are cared for, providing support that might not be found elsewhere. Robust lifelong learning systems can build the adaptability and resilience required for the future of work. But these trends also raise questions: What is the role of education in preparing for life outside of work? For continuous learning beyond the context of formal education? How can education systems better recognise and build on what is learnt outside of school?

In this changing context, **chapter 3** turns to **Knowledge and power**. Digital technologies enable almost endless data and information, providing new, powerful means to make decisions and solve problems. Yet, new issues have emerged, such as how to deal with abundant, sometimes fake or misleading information in a rapidly changing context, and how best to successfully mobilise our collective intelligence. In today's world, greater information and knowledge come with greater uncertainty. Governing knowledge effectively is central to both individuals and collectives.

Promoting relevant research and scaling up effective innovations is key to enhancing education's quality. But this readily accessible universe of information triggers essential questions just as powerful algorithms raise issues of ethics, transparency and accountability. How do we support all individuals to not only access information, but know what to do with it when they have it? Can we develop more inclusive governance, enhance evidence use and quality and increase public trust?

Chapter 4, **Identity and belonging**, explores the importance of understanding who we are and where we belong. In a global and digital world, individualisation and choice increasingly define our lives and traditional binding powers like religion and nationhood are declining in many countries. The virtual world facilitates the exploration of identities in entirely new ways, giving individuals and groups greater voice and allowing new forms of belonging. Yet still, societies are becoming more fragmented and many forms of disadvantage and discrimination remain unchallenged.

Education must meet the needs of diverse learners while simultaneously cultivating global competences for the 21st century. Education can help socialise students into common norms and values while supporting the positive identities and agency needed to pursue learning and well-being. Identifying and reducing discrimination and disadvantage is a key first step to ensuring accessible, adaptable and affordable education for all.

Lockdowns and social distancing in the pandemic pushed us to reflect about our relationships with others, with nature and with ourselves. **Chapter 5**, **Our changing nature**, highlights the intertwined societal and environmental processes that shape human well-being, from food production and eating to digital communications and face-to-face relations. We must find a new relationship between innovation and progress, what is technologically possible and our societal and planetary needs. Climate change has given us an imperative; ongoing advances in physical, cognitive and emotional enhancement further raise fundamental questions about what it means to be human.

Education can help foster thriving relationships with our minds and bodies, with others and with the natural world. It is key to helping us think through emerging social and ethical challenges, taking into account individual as well as collective and planetary well-being.

Preparing for the unexpected

Connecting global trends to education is a means of broadening our horizons and informing the base of decision making. But future thinking means considering the complex evolution of existing trends as well as potential developments and shocks. This volume thus connects the trends to the OECD Scenarios for the Future of Schooling, presenting alternate futures to push the reader to be prepared for the unexpected. This is crucial: as the COVID-19 pandemic reminds us, the future can and will surprise us!

Global trends and the future of education

What impact will climate change have on our educational institutions in the next decade? Are our research and innovation systems prepared for an era of global, open and internet intensive science? What does it mean for schools that our societies are becoming more individualistic and diverse?

What is Trends Shaping Education?

Trends Shaping Education is designed to support long-term strategic thinking in education. It provides an overview of key economic, social, demographic and technological trends and raises pertinent questions about their impact on education.

Examining the future of education in the context of global trends has two main goals. First, it is necessary to better prepare education for the transformations underway in economic, social and technological spheres. Education must evolve to continue to deliver on its mission of supporting individuals to develop as persons, citizens and professionals. A better understanding about the ways our world is changing is a key first step in this direction.

Second, observing ongoing trends helps us reflect about the potential of education to shape them. By providing the competencies needed to operate in the modern world, education has the potential to influence the life outcomes of the most disadvantaged. It can help combat the increasing fragmentation in our societies, and empower people to realise change in their communities.

The first edition of *Trends Shaping Education* was published in 2008 and subsequent editions appeared in 2010, 2013, 2016 and 2019. The 2022 edition contains 25 trend areas each illustrated by two figures. This content is organised in five chapters: growth, living and working, knowledge and power, identity and belonging, and our changing nature.

While all the trends included are relevant to education, not all relevant trends are in this resource. The criterion for selection has been the availability of internationally comparable, through-time evidence from OECD and other robust data sources. The focus is primarily on OECD countries, though broader global data are included when available. While long-term trends were prioritised for inclusion, in some cases the trends are charted over a shorter period – for instance, for rapidly changing technological trends.

This work does not give conclusive answers: it is not an analytical report nor is it a statistical compendium, and it is certainly not a statement of OECD policy on these different developments. While the trends are robust, the questions raised for education in this book are illustrative and suggestive.

Trends Shaping Education is aimed at policy makers, researchers, educational leaders, administrators and teachers. It will also be of interest to students and the wider public, including parents. We invite users to look further and to add to this basic coverage examples of trends from their own countries or regions. Importantly, the future is always in the making. We hence invite readers to consider both the set of trends as well as the different ways they might evolve in the future.

Trends and future thinking

Opinions differ on historical developments and, even when there is agreement, the future is rarely just a smooth continuation of past patterns. Moreover, we do not know in advance which trends will continue and which will change course, or in what context. Sometimes, we can just be plain wrong.

> "Television won't last because people will soon get tired of staring at a plywood box every night".
>
> - Darryl Zanuck, film producer, 1946

Similarly, it is not guaranteed that the trends that were important in the past or seem so now will remain influential; emerging trends, barely visible at the moment, may become crucially important in the future.

> "Remote shopping, while entirely feasible, will flop".
>
> - Time Magazine, in 1966

In the absence of any concrete facts or evidence about the future, the only way to meaningfully understand the future is through dialogue. The future cannot be passively observed. It must be actively discussed in order to learn from it. These learnings can then be used to identify and agree upon actions for today.

Relevance, pace and impact

The *Trends Shaping Education* series is designed to provide creative fuel for reflection on the long-term strategic future of education. It has been used in Ministries, international organisations, professional and student organisations and other civil society groups as part of strategic planning exercises. It has been integrated into teacher education curricula, used in classrooms by teachers, and harnessed by school boards and parents for future-thinking exercises.

This work is most valuable when used as a tool and adapted to the specific context of the user. In order to do this, key questions include:

How relevant is this trend in my context?

Context matters. Ageing populations, for example, may be a bigger challenge in rural than in urban areas or concentrated in certain parts of the country or districts in a city. The impact of most trends will depend on geographical, historical, political or cultural circumstances.

What is the speed and impact of this trend?

Some trends develop slowly (global temperatures went up around 0.8˚C in the last 100 years) while other trends are more dynamic (the number of active Facebook users went from zero to 1 billion in eight years). Slow trends allow more time to think about what they mean and how to respond but they may also be difficult to change. Climate change may be slow, for example, but its potential impact is enormous, possibly threatening life on our planet.

Can we influence this trend?

Even if trends are not predictable, it is often possible to influence them. Small individual steps from parents and peers can make a difference in rates of cyberbullying in schools, for example. Broader coordinated action from multiple players, including school boards and government, can change cyberbullying policies

and regulatory frameworks. All of these elements are important to reduce the prevalence of this harmful trend.

Can we react to these trends?

Creating the flexibility to react to the unexpected is important. For example, emergency planning to handle extreme weather events in cities will include a variety of scenarios, each of which may or may not be deployed in the event of a major crisis. The key is to maintain flexibility and responsiveness even under unforeseen circumstances.

Are there other trends to take into account?

In a word: yes. The trends in this book are a snapshot of our changing world. To be useable, the book is necessarily brief, and there are certainly other trends that are just as important to consider. All five previous *Trends Shaping Education* publications present complementary trends that are still relevant, and we encourage the fans of this series to explore those too. Hint: if you are interested in democracy and ageing, have a look at the 2019 edition. If cities and biotech, see the 2016 edition. If skills and well-being, the 2013 edition has a special section on this.

The future likes to surprise us: From trends analysis to using scenarios

Much of our thinking of the future is linear, based on extending currently existing trends. But not all trends are created equal. Some trends, for instance those related to population growth or climate change, lend themselves easily to long-term planning. Others are less predictable, such trends in technology or youth culture. Trends slow, accelerate, bend and break. And as the COVID-19 pandemic reminds us, unforeseen events can disrupt even long-standing trends.

This volume departs from previous editions by incorporating two new elements:

- It highlights some of the unexpected ways in which COVID-19 has and is still disrupting global trends, with a special section for each chapter.
- It connects each chapter theme with a mini-scenario exercise, stimulating readers to reflect on how the future might differ from our current expectations.

Connecting to the four OECD Scenarios for the Future of Schooling

In the face of fast-changing trends and unexpected events, using scenarios allows us to explore the implications of multiple alternative futures. The four OECD Scenarios for the Future of Schooling have been constructed in a time frame of approximately 15-20 years: long enough for significant change to occur beyond immediate political cycles, but not so far off as to be too remote for anyone except futurists and visionaries.

Each of these alternative futures is elaborated in the last two pages of this introduction, structured around four common design principles: i) goals and functions, ii) organisation and structures, iii) the teaching workforce, and iv) governance and geopolitics. The Reader is invited to use these scenarios with the corresponding exercises at the end of each chapter to explore alternative futures in a structured way – for schooling, certainly, as well as for other levels of education and its institutions.

Future thinking is designed to foster reflection and discussion. Above all, we hope that the different users of this report will ask the question: “What might this trend mean for my work, and are we prepared for the different scenarios?”. Or better still, “How do these trends and scenarios, taken in combination, redefine the context in which I am making decisions?”. This can help gauge our preparedness for different possible futures, and prepare now.

Scenario 1 | Schooling extended

Goals and functions

Qualification, care, credentialing, socialisation

- Participation in formal education continues to expand. Academic certificates continue to be the main passports to economic and social success.
- The curriculum rises to the fore, with countries operating a common curriculum and assessment tools.

Organisation and structures

Spaces, content, time, relationships

- International public-private partnership powers digital learning environments. Learning resources and data are shared across countries.
- The organisation of instruction and student-teacher interactions remain mostly unchanged, although there is room for innovation.

The teaching workforce

Professional status, tasks, certification

- More personalised learning alters the nature of teachers' work, with subsequent impact on teacher education and professional development.
- There is marked division of tasks and greater diversification of professional profiles in school networks, which now benefit from larger economies of scale.

Governance and geopolitics

Actors, power relations, participation

- Strong role for traditional public administrations.
- Increased emphasis on partnerships and international collaboration.

Scenario 2 | Education outsourced

Goals and functions

Qualification, care, credentialing, socialisation

- Driven by greater parental involvement, diverse forms of private and community-based initiatives emerge as alternatives to schooling.
- Choice plays a key role: of those buying educational services and of those, such as employers, giving market value to different learning paths.

Organisation and structures

Spaces, content, time, relationships

- As education outsourcing expands, traditional bureaucratic governance and system-wide accountability shrinks.
- Greater choice in learning programmes (length, scope, cost, etc.) provides learners with flexibility to move at their own pace.

The teaching workforce

Professional status, tasks, certification

- There is greater variety of teaching profiles and working arrangements, with implications for professional and reputational status.
- Learning networks, such as massive digital learning platforms, bring different human resources together according to perceived need.

Governance and geopolitics

Actors, power relations, participation

- Greater reliance on societal self-organisation.
- Schooling systems as players in a wider (local, national, international) market.

Scenario 3 | Schools as Learning Hubs

Goals and functions

Qualification, care, credentialing, socialisation

- Schools retain most of their functions, but new forms of competence recognition systems liberate them from pressures of credentialism.
- Move away from uniformity: Local actors develop their own initiatives to realise the values they consider important.

Organisation and structures

Spaces, content, time, relationships

- Experimentation and diversity of pedagogies are the norm. Personalised pathways are strengthened within a framework of collaborative work.
- Activities are planned in the context of broader learning ecosystems, mapping opportunities across an interconnected network of educational spaces.

The teaching workforce

Professional status, tasks, certification

- Knowledgeable, networked teachers coexist with diverse individual and institutional players offering a variety of skills and expertise.
- Strong partnerships leverage resources of external institutions, such as museums, libraries, residential centres, technological hubs and more.

Governance and geopolitics

Actors, power relations, participation

- Strong focus on decision making at the local level.
- Self-organising units in diverse partnerships.

Scenario 4 | Learn-as-you-go

Goals and functions

Qualification, care, credentialing, socialisation

- Digitalisation has made it possible to assess and certify knowledge, skills and attitudes in a deep and almost instantaneous manner.
- Learning opportunities are widely available for "free", marking the decline of established curriculum structures and dismantling the school system.

Organisation and structures

Spaces, content, time, relationships

- Education builds on digital technology and artificial intelligence to leverage collective intelligence and solve real-life problems.
- Dismantling of schooling systems and repurposing of its infrastructure. Distinctions between education, work and leisure become blurred.

The teaching workforce

Professional status, tasks, certification

- Difficult to envision the role of governments vis-à-vis markets and civil society. Data ownership and its geopolitical implications are key.
- Traditional teaching professionals vanish as individuals become “prosumers” (professional consumers) of their learning.

Governance and geopolitics

Actors, power relations, participation

- Deinstitutionalisation of public education, dismantling of schooling.
- (Global) governance of data and digital technologies potentially key.

1 Growth

Economic growth has raised the living standards of many, but social and environmental sustainability remain a challenge. Education can foster adaptability in a changing global economy and encourage reflection on the type of future we want to build. This chapter explores these issues through five themes:

- **Growing prosperity**: highlights how economic growth has improved living standards and reduced extreme poverty.
- **A new source of growth**: presents a new driver of economic growth: investment in intangible assets.
- **Demographic pressures**: examines the pressures of population ageing on fiscal and social sustainability.
- **A growth revolution?**: contrasts the shift towards renewable energy with increasing energy consumption and reliance on fossil fuels.
- **To infinity and beyond**: illustrates the potential benefits and challenges of the growing space economy.

These trends are linked to education and its future through a series of questions and scenarios. Potential implications of COVID-19, both immediate- and longer-term, are discussed.

Overview and impact of COVID-19

Global economic growth has lifted millions out of poverty and raised living standards worldwide. Yet despite increasing affluence, socio-economic inequalities are widening. Rising production and consumption of products and services requires more energy, and the unsustainable use of resources, both natural and human-made, is straining our environment. As we reach for the stars to conquer new economic opportunities, channelling life on Earth towards a path of social and environmental sustainability becomes increasingly urgent. Education can be key to strengthening our versatility for an evolving global economy and providing space for us to collectively imagine the future we want to grow in.

Growth & COVID-19

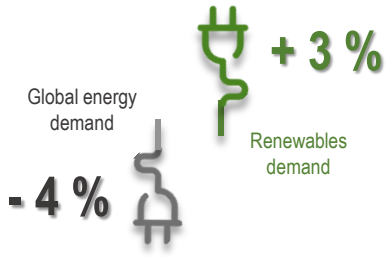
The COVID-19 pandemic is a reminder that, despite our best laid plans, the future likes to surprise us. Trends can accelerate, bend and break. As the shock subsides, open and important questions emerge about the long-term effects of these shifts.

ACCELERATE

Will renewable energy deployment accelerate as the global economy recovers?

The use of renewables in energy generation gained momentum during the pandemic. Yet, renewables still account for a tiny share of the energy consumed globally.

Change in global energy demand vs. demand for renewables, 2020



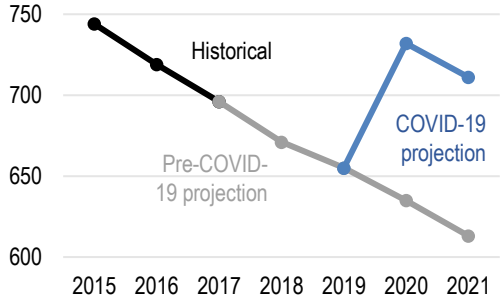
IEA (2021), https://www.iea.org/

BEND

Crises disproportionately affect the most vulnerable. Will we be more resilient for the next one?

The pandemic interrupted more than two decades of continuous progress in poverty reduction. While extreme poverty is once again declining, almost 100 million more people were pushed into poverty in 2020.

Global extreme poverty, millions of people, 2015-2021



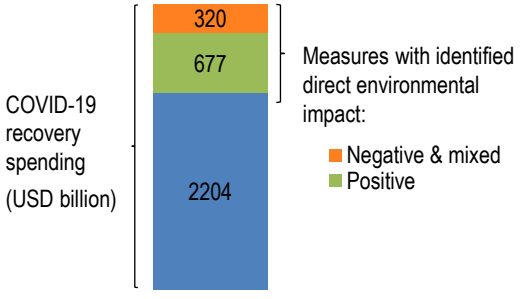
World Bank Group (2021), https://blogs.worldbank.org/

BREAK

As the economy recovers, will it break with an unsustainable model?

OECD and key partner countries deployed unprecedented economic recovery packages. Despite the urgency of action on climate, about one in three measures with direct environmental impact are expected to have negative or mixed effects.

Estimated environmental impact of COVID-19 recovery measures, mid-2021



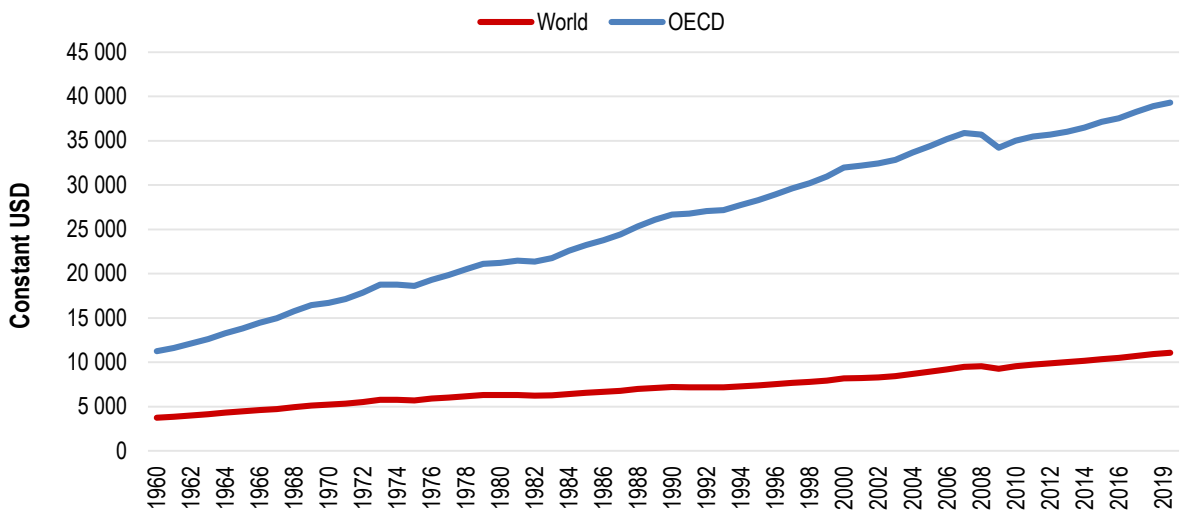
OECD (2021), https://www.oecd.org/coronavirus/

Growing prosperity

For over 50 years, affluence has increased across the world, and in OECD countries in particular. Global economic integration and technological progress have contributed to a steep reduction of extreme poverty and the improvement of material welfare for many. However, not everyone has benefitted equally. Inequalities have been widening, and rising affluence globally obscures existing divides, within and across countries. By enabling social mobility, and cultivating the competences necessary for individuals to participate in the economy, education can benefit both social progress and economic development.

Figure 1.1 Increasing affluence

Gross domestic product (GDP) per capita, constant 2015 USD, 1960-2019



Source: World Bank (2021), "GDP per capita (constant 2015 US$)", (indicator), https://data.worldbank.org/.

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The world has witnessed significant economic growth over the past decades, as forces like international trade liberalisation and technological progress helped raise living standards worldwide. Global GDP per capita more than doubled from 1960-2019, and all OECD countries have seen their GDP per capita rise in the long run. The same forces that generated such growth have also helped reduce extreme poverty in recent decades through the creation of jobs, the rise of overall wage levels and the decrease in commodity prices. While the absolute number of people living in extreme poverty in 1820 (757 million) is similar to that of 2018 (764 million), once the exponential growth in the world population has been factored in, the share of people living in extreme poverty over the past two centuries fell, from 76% to 10%.

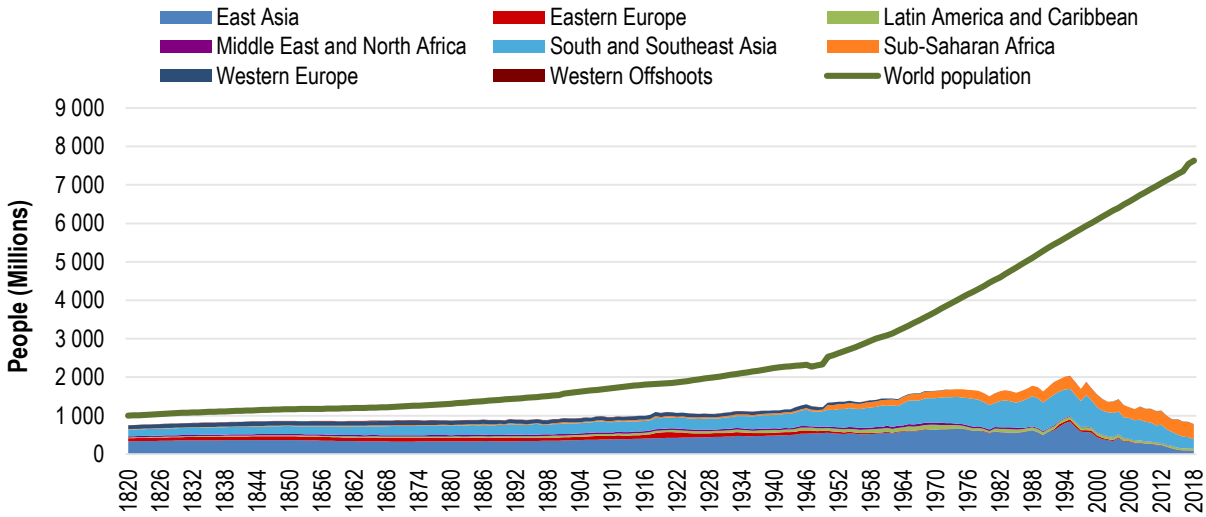
However, increasing global affluence masks inequalities across and within countries. A considerable per capita income gap persists between countries. In 2019, the GDP per capita for OECD countries was about USD 39 307, more than three times than the world average of USD 11 057. Moreover, within country income inequalities have also been rising in recent decades in many countries, as the benefits of economic growth increasingly concentrate in the hands of a few.

These trends matter: high and rising income inequality undermines education opportunities for students from poor socio-economic backgrounds, lowering social mobility and hampering skills development, all of which decrease countries' ability to promote and sustain strong economic growth. Developing a high-quality and equitable education system is an investment in the future. Education has in fact the unique

power of directly tackling the sources of inequalities affecting our societies. From early learning and care to adult education, education contributes to both economic development and social progress, supporting the development of citizens and helping distribute life opportunities more evenly across society.

Figure 1.2. Expanding population, shrinking extreme poverty

People living in extreme poverty worldwide, 1820-2018



Note: The data on extreme poverty for several Sub-Saharan African countries were included from 1950 onward.
Source: Moatsos M. (2021), "Global extreme poverty: Past and present", in OECD (2021), *How Was Life? Volume II: New Perspectives on Well-Being and Global Inequality since 1820,* https:// doi.org/10.1787/3d96efc5-en.

StatLink https://stat.link/fiwm3u

And education?

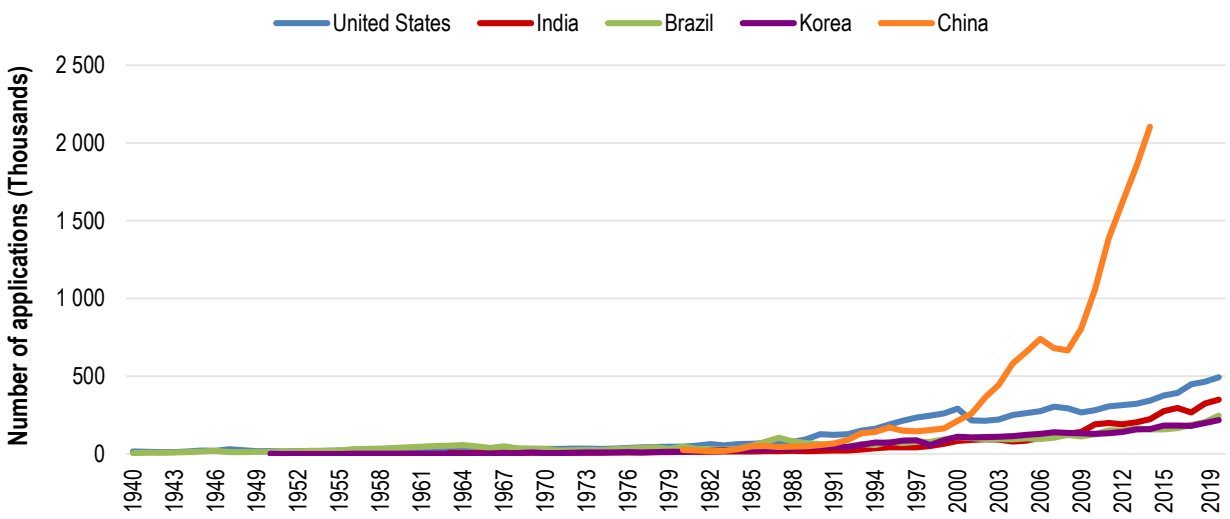
- Education contributes to equipping individuals with the skills needed to participate in society and the economy. Is there room to collectively imagine what these might be? Do education institutions, such as schools and universities, allow space for education stakeholders to reflect on the future they want to build together?
- Strategic investments in education can help reduce inequality. How can educational resources be distributed to best serve those most in need? Do disadvantaged students have access to financial support for non-compulsory education, including non-formal education?
- Education institutions are key anchor institutions for communities. How can they best contribute to local sustainable social and environmental development? What pedagogical approaches, partnerships and procurement policies are needed to make a difference?

A new source of growth

Over recent decades, investment started to shift from traditional tangible assets like machinery and buildings to intangible assets. Intangibles have no physical form; they are knowledge-based resources like intellectual property and data. While this shift towards intangibles continues to gain momentum, their unique characteristics have major economic and social implications. For instance, the scalability of intangible assets and their tendency to develop valuable synergies with each other have enabled great wealth to concentrate among a small number of intangible rich firms, feeding into rising inequalities. As the economy shifts, the skills that markets value shift with it. How can education best support a future-fit workforce?

Figure 1.3. Intangible innovation

Trademark applications for the top five offices, 1940-2019



Note: Data for the China office from 2015-2019 were unavailable.
Source: WIPO (2020), *World Intellectual Property Indicators 2020,* https://www.wipo.int/.

StatLink https://stat.link/8wyi5x

Investment in intangible assets has grown gradually over the past 40 years. This investment centres on assets like data, software, skills, new organisational process and intellectual property, like attributed designs and patents. Trademarks are another example of intangible assets that fall under the category of intellectual property. Applications to register trademarks have been increasing since the 1980s, especially for Brazil, China, India, Korea and the United States, the top five offices in terms of the number of trademark applications received. Trademark applications filed at the United States office have more than doubled since the mid-1990s, reaching almost 500 000 applications in 2019. China now leads in trademark activity, exceeding the United States in 2001 and increasing its trademark applications by more than 3 000% between 1990-2014.

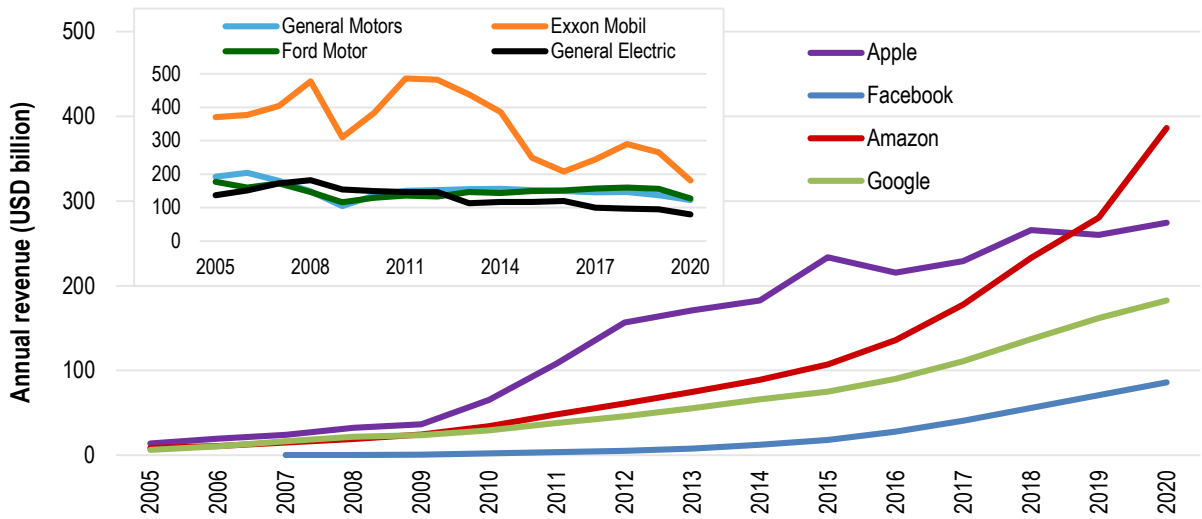
Intangibles like intellectual property and brand strategies are key in today's economy. An example of their power is the growth of a few tech companies compared to the declining revenue of the traditional companies that dominated the *Fortune 500* decades ago. While Amazon's revenue increased by over 4 000% from 2005 to 2020, Exxon Mobil's decreased by about 50%.

Unlike tangible assets, intangibles can be used repeatedly and in multiple places at the same time. Such scalability helps explain how firms like Apple, Amazon and Google grew so rapidly in just 15 years,

generating over USD 180 billion in revenue in 2020 alone. However, these large firms' investment in intangible assets contributes to increasing market concentration, which stifles competition and threatens long-term growth and innovation by widening the productivity gap between these frontier firms and their lagging competitors. As intangible assets are increasingly valued, education's role in developing individuals' technical and soft skills to innovate new products and business processes will grow in importance.

Figure 1.4. The rise of Big Tech

Annual revenue of top four companies from the Fortune 500 in 1960 vs "Big Four" tech companies, 2005-2020



Source: OECD (2019), *An Introduction to Online Platforms and Their Role in the Digital Transformation*, https://doi.org/10.1787/53e5f593-en; companies' annual reports; and https://macrotrends.net.

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And education?

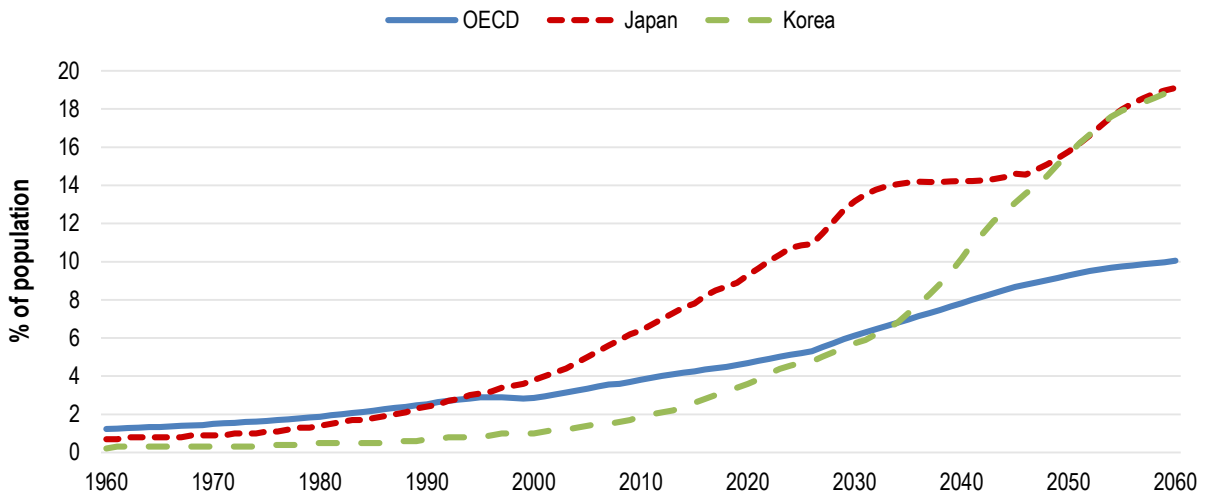
- What competences are needed for participating in an increasingly intangible economy? For generating new ideas and products? Organising and governing new ways of working and producing?
- A skilled population that is ready to meet the demands of a rapidly evolving economy characterised by technological change renders lifelong learning increasingly necessary. What is the role of new technologies in facilitating adult and mid-career education and training?
- Big tech firms are becoming important players in education, especially through the provision of digital education platforms and services. What are the implications for education governance? What kinds of (public-private) cooperation and leadership are needed to deliver public value?

Demographic pressures

Across the OECD, the elderly population is growing and fertility rates are falling. While population growth comes with its own set of challenges, so does population decline. Pension and healthcare system needs, especially in long-term care, will exacerbate fiscal pressures and raise concerns about economic growth. How can we ensure social and fiscal sustainability in response to this ongoing demographic transition? Integrating older workers in the workforce and improving labour efficiency through means including technological innovation holds the potential to offset negative effects. In this context, the provision of high-quality education, as well as the redistribution of learning opportunities over the lifecycle, is part of the solution: upskilling, reskilling and retraining can build the capacity for all citizens to contribute to society, no matter their age.

Figure 1.5. Growing grey

Share of the population aged 80 years and over, 1960-2060



Note: Historical data used from 1960-2020. Projections are from 2021-2060.
Source: OECD (2021), "Population age structure", *Demographic references* (database), https://stats.oecd.org/; OECD (2021), "Population projections", *Population Statistics* (database), https://stats.oecd.org/.

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Thanks to better health care and rising living standards, a greater proportion of the world population is living longer. On average across OECD countries, the share of the population aged 80 and older is expected to double, from 5% in 2020 to over 10% in 2060. This raises concerns for fiscal and social sustainability. As pension systems depend on the working population to help pay for the elderly, a reduced share of working-age population places these systems under strain. Health and social protection, including old age pensions, already comprise the largest areas of social spending in OECD countries, accounting respectively for about 8% and 13% of GDP across the block.

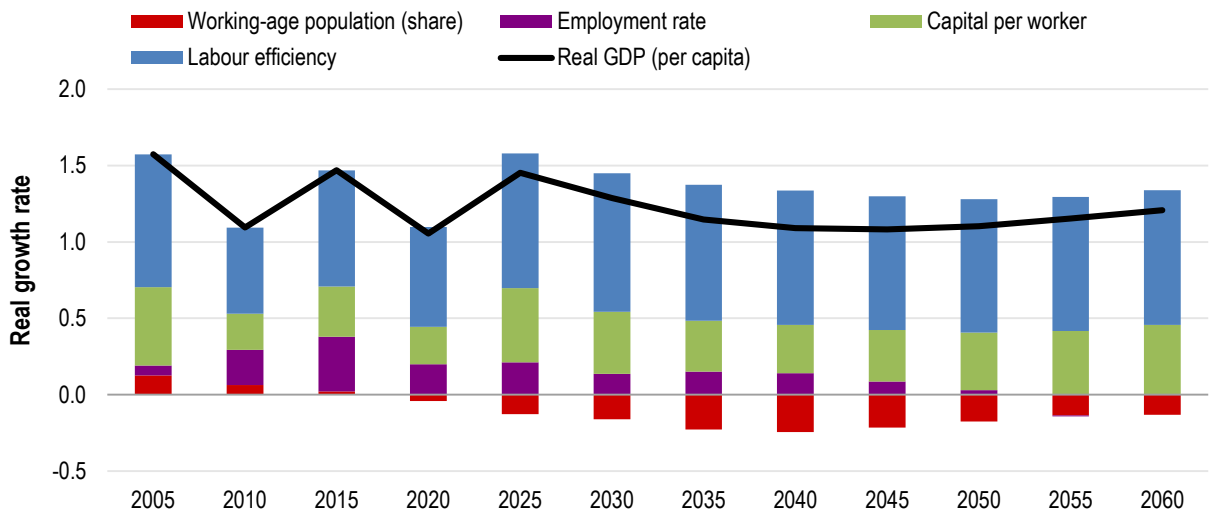
With ageing societies, this spending is predicted to continue to increase. Furthermore, the number of elderly people in need of care is projected to increase by 100 million worldwide between 2015 and 2030, exacerbating the challenge of recruiting and retraining enough long-term care workers to satisfy growing demand.

One potential way to alleviate pressure on public finances is through labour market reform. For instance, lifting employment rates and increasing legal retirement ages could help offset the strain on

public budgets. Growth in labour productivity could also offset consequences of an ageing population. Technological innovation driven by research and development (R&D) spending and a highly-skilled workforce could spur such an improvement in productivity. Education and lifelong learning can be key in engaging older individuals in the workforce and equipping people for jobs that maintain countries' productivity levels and growth in the face of a smaller workforce.

Figure 1.6. Productivity as an offset to an ageing population?

Real GDP per capita growth in the OECD area in the baseline scenario, 2005-2060



Note: Baseline OECD projections, devised under a no-policy-change assumption, highlight that population ageing may negatively affect growth in living standards. However, improvements in labour productivity can help offset this effect and lift GDP per capita growth.
Source: OECD (2021), "The long game: Fiscal outlooks to 2060 underline need for structural reform", https://doi.org/10.1787/a112307e-en.

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And education?

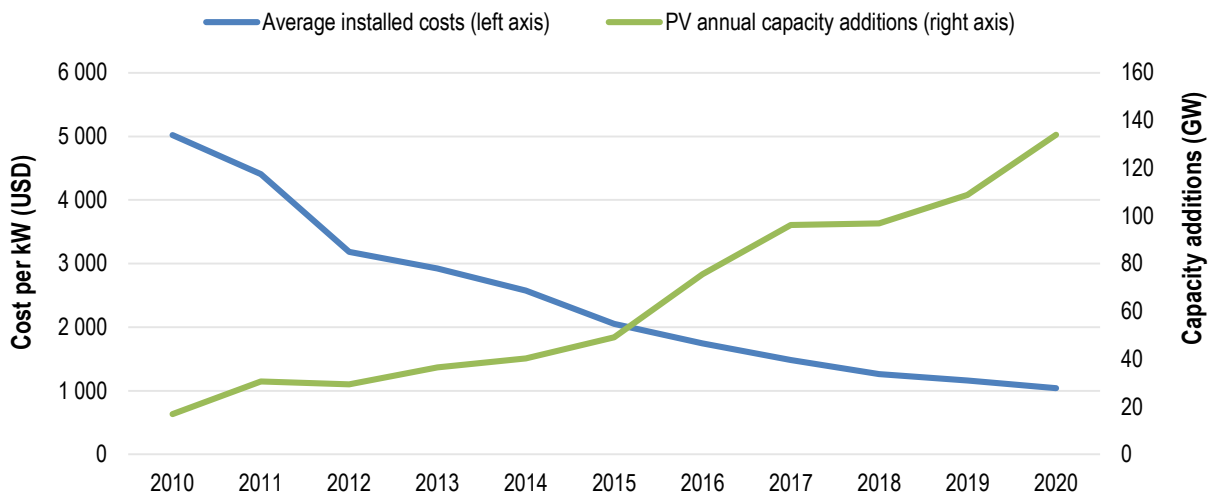
- Productivity is key to sustaining growth in living standards, but is encouraging higher levels of formal educational attainment the best way to promote a more productive workforce? Which factors are key to influencing productivity, and how could education adapt to better promote them?
- Employers tend to rely on traditional signs of skills attainment (e.g. degrees, reputation of education institutions). Is this likely to change? If so, how? What could this mean for education (e.g. shorter schooling careers? The end of traditional degree programmes?) and for society?
- Falling fertility rates will pose new challenges for public services, including education. At the same time, what opportunities might they offer? Smaller class sizes and/or lower student to teacher ratios, for example? Opportunities for the eldest seniors to re-engage with education? Others?

A growth revolution?

Throughout history, humanity has been able to adapt to societal challenges through ingenuity and technological innovation. In the face of climate change we are once again put to the test. An environmentally sustainable path towards economic growth exists potentially through green technological advancements and sustainable practices. However, some question if "green growth" can truly offset our growing consumption and waste generation. The increasingly urgent pressure to address climate change underlines the importance of preserving the well-being of the planet and the livelihoods associated with it. How can we reconceptualise growth, to reconcile prosperity and environmental sustainability? Will education enable people to develop agency and co-agency as well as a better appreciation of the connections between the present and the future, between different parts of the world and across different groups of people, which are necessary for building a sustainable future?

Figure 1.7. Got solar?

Installed annual capacity and average cost of solar PV systems worldwide, 2010-2020



Source: IEA (2020), *Renewable Energy Market Update: Outlook for 2020 and 2021*, www.iea.org; IRENA (2021), *Renewable Power Generation: Costs in 2020*, https://www.irena.org/.

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Renewable energies are called upon to play a key role in achieving a model of economic development that is more sustainable. As demand for renewables has increased significantly and their technology has improved, the costs of renewables have fallen, especially for solar photovoltaics and wind energy. For instance, the real cost of solar photovoltaic systems fell by almost 80% since 2010, in tandem with rising solar photovoltaic annual installation reaching almost 135 GW in 2020.

Harnessing these increasingly affordable technologies can foster green growth. Such growth can, in turn, help mitigate climate change and decrease air pollution while enhancing job creation and the resilience of the overall energy system. However, faster scaling of renewable energy is needed to achieve global net zero emissions as soon as possible, to keep the goal to limit the increase in global average temperature to 1.5°C within reach and meet climate targets based on net zero emissions by 2050.

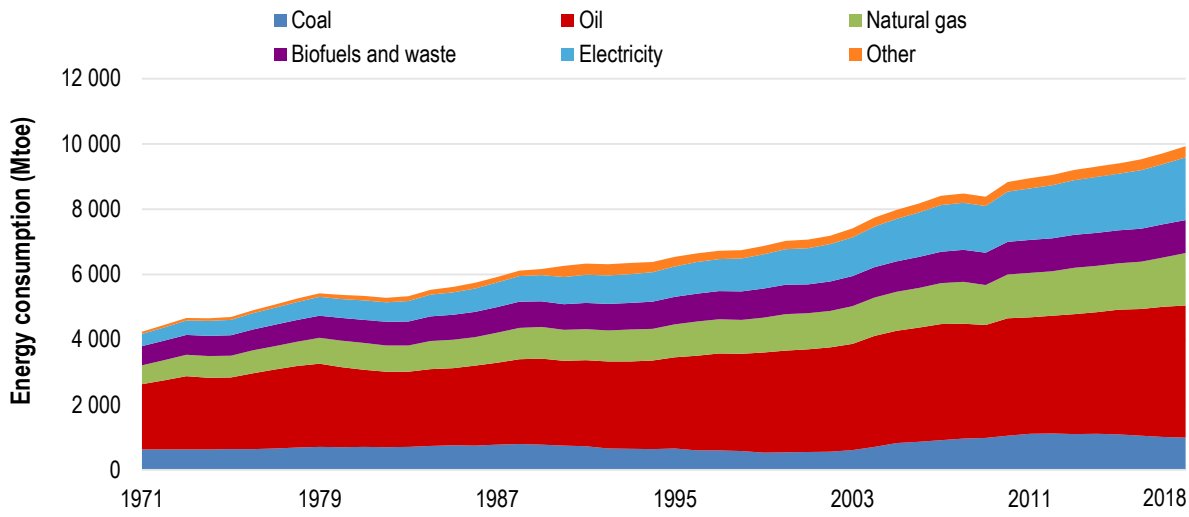
While the availability and affordability of renewables have increased, fossil fuels like oil and natural gas continue to comprise the largest shares of total final energy consumption globally. In 2018, oil accounted for about 41% of total final energy consumption, while natural gas accounted for 16%. The shift towards

renewable energy has not kept pace with rising worldwide energy demand driven by a growing world population and consumption patterns. Fossil fuels continue to be burned at an unsustainable rate, highlighting the need to accelerate the growth of renewables and reduce global CO_2 emissions.

However, transitions are challenging; the policies that facilitate green transitions are often accompanied by trade-offs, such as demands for citizens to alter some of their behaviours (e.g. driving a polluting car) and job losses in polluting industries. By fostering the development of "green skills", education can support a greener and more inclusive economy that addresses distributional impacts and skills gaps.

Figure 1.8. Fossil fuels are still king

World total final energy consumption (TFC) by source, 1971-2018



Note: Other includes heat, solar thermal and geothermal energy.
Source: IEA (2020), *Key World Energy Statistics 2020,* https://www.iea.org/.

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And education?

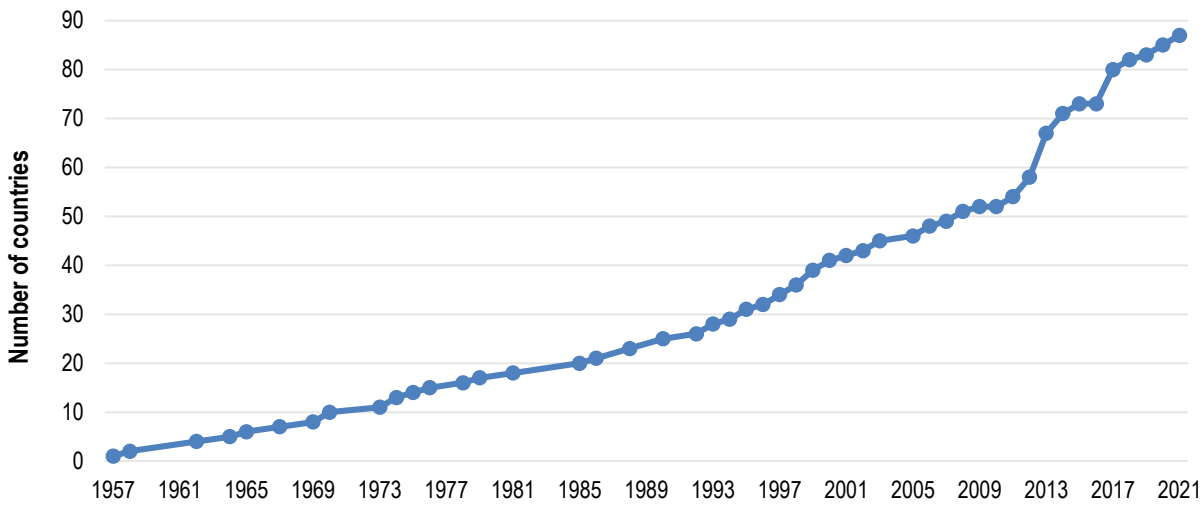
- Skill shortages could hinder the development of a "greener" economy. Which tools could prevent such shortages? Apprenticeships, VET, and other forms of work-based learning? Career guidance? In your system, are there programmes in place supporting current workers and industries to adapt to changing standards and requirements?
- How can education develop students' environmental awareness as well as encourage them to translate such knowledge into sustainable attitudes and behaviours (individual and collective)?
- Rethinking economic growth requires technical skills as well as creative and critical thinking. How might content and curricula be adapted to encourage greater intellectual diversity and address the cross-disciplinary challenges for sustainable growth?

To infinity and beyond

Humanity's reach is expanding even in outer space, as we revisit old targets like the moon and aim for new destinations like Mars. The space economy is growing fast: along with a rising number of satellites in orbit, projects on space mining, interplanetary habitation and space tourism are underway. However, all this activity is not consequence-free. The remains of satellites and rockets increasingly litter Earth's orbit, colliding with other objects and threatening future space missions and functional satellites. While technological advancements have enabled our expansion into space, innovation must also help ensure the sustainability of growth and extra-planetary endeavours. Equipping individuals with the right skills will thus be key for humanity to keep expanding its horizons.

Figure 1.9. Eyes in the sky

Number of countries with a registered satellite in orbit, 1957-2021



Source: Adapted from OECD (2019), *The Space Economy in Figures*, https://doi.org/10.1787/c5996201-en.

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In 1957, the Soviet Union launched the first satellite, Sputnik 1, into space. Since then, the number of countries participating in space activities has increased dramatically. Between 2008 and 2021, for example the number of countries with registered satellites increased from 50 to 87. Increasing affordability and accessibility of technology have facilitated the surge of satellites in space, with, for example, low-cost small satellite technology permitting the exponential growth of small satellite deployment.

In this context, private sector actors are increasingly participating in the space economy to take advantage of the vast opportunities it has to offer. Satellites, for instance, are associated with diverse research and commercial opportunities including space exploration, climate research, navigation and telecommunications, which all play an important role in societies' functioning and economic development. Satellite filings, which reflect existing plans to launch new satellites in the coming years, suggest that there could be several tens of thousands of operational objects in orbit by 2030.

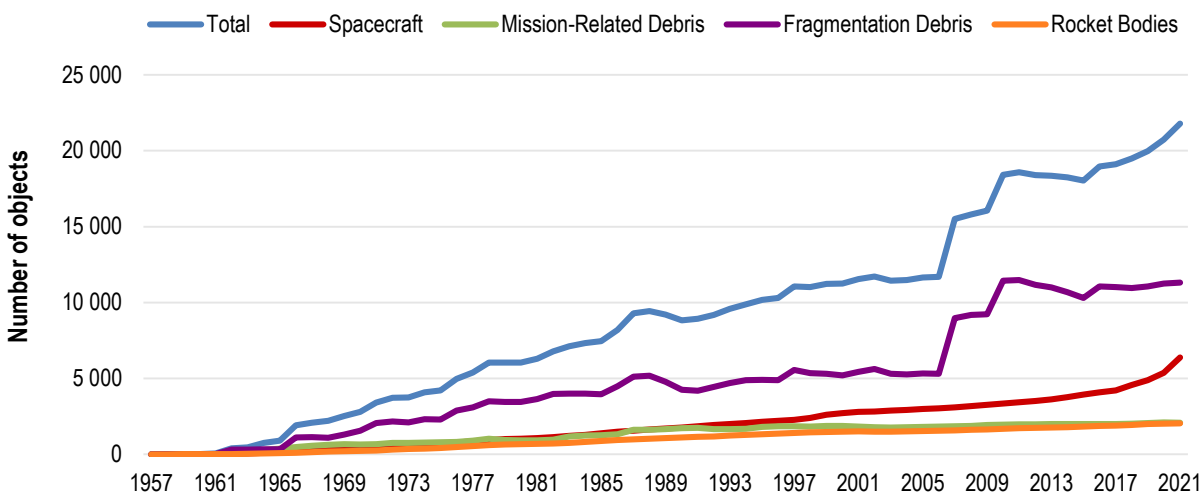
However, space activity also creates space debris. Since 1958, the amount of space debris increased almost 11 000 times. By the start of 2021, around 22 000 debris-related objects were in orbit. Debris moving at high speeds threaten to wreck functioning satellites and spacecraft, potentially disrupting weather forecasting, climate research and military missions. This can have social costs, as remote and

rural communities would suffer disproportionately from a loss in satellite connectivity, which is essential to their digital access. Technological innovation will be crucial to ensuring debris removal and sustainability of future space activities.

Just as importantly, space-based technologies can support sustainable terrestrial growth, for instance, by monitoring climate change factors including sea levels, ice sheet flows and air pollution. Yet expanding the sector requires expanding its workforce. Education will be key in addressing the skills shortage of the space sector and preparing innovators who can promote sustainable development through space-based technologies, on Earth, to infinity, and beyond.

Figure 1.10. In space no one can see you litter

Number of objects in Earth orbit by object type, 1957-2021



Source: NASA (2021), *Orbital Debris: Quarterly News*, https://orbitaldebris.jsc.nasa.gov/.

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And education?

- Preparing people for emerging jobs often involves training them to use state-of-the-art technology. Are education institutions equipped to meet this goal? If not, what is needed? New partnerships for apprenticeships or programmes? Greater investment in digital training, simulators and virtual reality? What is the role of non-formal learning in this process?
- Increasingly, the space economy offers cost-effective, ubiquitous and easy to deploy solutions to improve connectivity in rural and remote areas. As they evolve, can satellites play a bigger role in bridging digital divides, ensuring adequate broadband speed and quality to all students, from the youngest child to the oldest senior?
- Space science is a fascinating and inspiring subject and can spark interest in STEM subjects. Can it foster greater interdisciplinary learning? For instance, could students design a constitution for human life on Mars (considering the many constraints this may be under)?

What future for growth and education?

Trends allow us to consider what current patterns might mean for the future. But what about new patterns, shocks and surprises that could emerge over the next 15 to 20 years?

Building on the OECD Scenarios for the Future of Schooling, this section encourages readers to consider how growth could connect with education to evolve in multiple ways. Two vignettes illustrate possible stories: the Reader is invited to adapt and create new ones as desired. The next page sets out some key questions for education, and a set of potential shocks and surprises that could impact education and learning in unexpected ways. The descriptions of each scenario can be found in the Introduction of this volume.

Scenario 1 Scenario 2 Scenario 3 Scenario 4

This week, the implementation of the 24/7 Schools reform was completed. “The reform builds on three key ideas,” says Francesca, a spokeperson from the ministry, “quality, quality, quality.” Schools have been grouped in district networks, each network managing a reduced group of well-trained and highly-paid teachers in charge of identifying high-quality learning resources and designing courses for all schools. Instruction and assessment are delivered mainly through digital technology, combining face-to-face classroom sessions with other dynamic activities. Learning sherpas accompany learners in schools, ensuring students remain focused and motivated, and moderate virtual classroom fora. “In 1990, we schooled all children in the country for the first time”, says Francesca. “In 2040, we are granting them access to the best teachers in the country, 24 hours a day, seven days a week.”

“You and dad look so young in this picture”, Marta whispers while flipping through her parents’ high school graduation yearbook. She often wonders what learning must have felt like back when there were schools for everyone. “You can look at it later, honey - Nishi is waiting for us”, exclaims Marta’s mum. Nishi is the home AI system, which delivers personalised training based on Oogle’s learning curriculum. Marta needs to remain focused. She is one of the finalists for the firm’s platinum scholarship and if she gets it, she will attend in-person courses for the first time in her life. Taught by Oogle’s top coaches and surrounded by some of the richest kids in the country, she will even get a class picture just like her parents. Marta smiles, “Good morning, Nishi. What a lovely day to learn!”

In 2040, things look quite different

Qualification, socialisation, care and credentialing arrangements may differ across alternative futures.

By 2040, how could the goals and functions of education be impacted by developments such as:

- inequality?
- climate change and consumption patterns?
- ageing?

What is expected from education?

Changing values, science and technology shape learning. In 2040…

- to what extent are education and learning front-loaded in early years?
- what new content is emerging (e.g. global competencies)?
- could climate change significantly impact school calendars/schedules?

How are space, content, time and relationships organised?

Who educates and in which conditions?

By 2040…

- are teaching activities and profiles more or less diverse?
- is teaching based on professional standards or is it more open access?
- do educational settings, such as nurseries, schools and universities, still exist in a physical format?

Who is responsible for what and accountable to whom?

Views on education differ across stakeholders, and so does their capacity to influence decisions. In 2040…

- what are the roles of government, market and civil society?
- is decision making transparent? Is it inclusive?
- in which ways does the geopolitical context affect the provision of education and learning?

Shocks and surprises

Despite the best laid plans, the future likes to surprise us. What would these shocks mean for education and learning if they came to pass? Can you see signs of other potential disruptions emerging?

Massive blackouts

Increasingly frequent extreme weather events and solar storms caused by sunspot activity wipe out much of the world's electric power grid causing days- or even weeks-long blackouts

Well-being economies

Human and planetary well-being are at the centre: waste and pollution generation have been eradicated, and so has material deprivation for all individuals

Colonisation of space

Farming, mining and food production is no longer restricted to planet Earth but becomes a competition between planets. Space armies are major investments - and not just by countries

Digital servitude

Tokenised social networks have monetised all digital activity. This drives greater inequality (as the rich keep getting richer)

Find out more

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Glossary

- **CO_2 emissions**: Carbon dioxide released into Earth's atmosphere from the burning of fossil fuels. Carbon dioxide is an invisible and odourless gas that contributes to climate change by trapping more heat in the atmosphere.
- **Extreme poverty**: The most severe type of poverty, characterised by the deprivation of basic human needs including food, clean water, shelter and education. The international community often defines it as living on an income below the international poverty line set at $1.90 per day. In this chapter, extreme poverty is measured by the "cost of basic needs" approach pioneered by economist Robert Allen. Here, poverty lines are calculated separately for every year and every country, using the different levels of consumption at which basic needs can be met, rather than a single global poverty line.
- **Frontier and laggard firms**: Frontier firms include the most productive firms in each industry and year. Laggard firms include those that are not counted as frontier firms. In recent years, the gap in productivity levels has been widening between laggard firms and frontier firms.
- **Globalisation**: The widening, deepening and acceleration of connections across national borders, especially the internationalisation of markets for goods and services, the means of production, financial systems, competition, corporations, technology and industries.
- **Gross domestic product (GDP)**: Standard measure of the value of the goods and services produced by a country. Gross means that no deduction has been made for the depreciation of machinery, buildings and other capital products used in production. Domestic means production by the residents of the country. Since many products in a country are used to produce other products, GDP is calculated by summing the value added for each product.
- **GDP per capita**: A metric for a country's economic output per person. It is calculated by dividing a country's GDP by its population. GDP per capita is the primary indicator of a country's economic performance and is often used as a general measure of countries' standard of living.
- **Intangible assets**: An item of economic value that is not physical in nature yet holds long-term value for a firm. Examples include data and proprietary software, patents and trademarks, human capital and organisational know-how.
- **Market concentration**: The extent to which market shares are concentrated among a small number of firms. Increasing market concentration in recent years has been used to argue that the intensity of competition between firms is decreasing.
- **Net zero emissions**: The elimination of emissions derived from the combustion of fossil fuels. Many countries have set a goal to achieve net zero emissions by 2050.
- **Patent**: A type of intellectual property granted by the government that legally permits an inventor to exclude others from making, using or selling their invention for a limited number of years, in exchange for public disclosure of the invention.
- **Registered satellites**: Machines registered by a national administration that are sent into Earth's orbit to collect information or relay signals for telecommunications. These satellites may involve little national expertise, as they can be purchased on the international market or developed in local universities.
- **Research and development (R&D)**: Research and creative work conducted by either the private and/or the public sector to develop new goods, techniques and services, and to increase the stock of knowledge and the use of this knowledge to devise new applications.
- **Renewable energy**: Energy generated from hydro (excluding pumped storage), geothermal, solar, wind, tidal, wave and biomass sources. Renewable energy is naturally replenished on a human time-scale, so it never depletes.
- **Scalability**: The ability of assets to be used repeatedly without limit, in multiple places and at relatively little or no cost. Intangible assets are highly scalable in nature. For example, a phone app is highly

scalable. While it requires upfront costs to develop the app software, producing additional units once it's developed has little to no cost.

- **Skills gaps**: The qualitative mismatch between the skills required by the labour market and the skills possessed by the workforce. Skills gaps may hinder the ability of employers to find adequately trained employees and of job seekers to find employment.
- **Space debris**: Non-functional and man-made objects and their fragments, which accumulate in Earth orbit. These fragments are derived from the launches of satellites and spacecraft, as well as from fragmentation-events like collisions and explosions in orbit. As space debris move through space at high velocities, they risk colliding with functioning satellite and spacecraft.
- **Tangible assets**: A physical item of economic value owned by a firm. Examples include buildings, inventory and machinery.
- **Trade liberalisation**: The removal or reduction of trade barriers, like tariffs and quotas, to facilitate the exchange of goods between countries. Benefits include countries' improved ability to harness their comparative advantage, keep prices low and promote greater competition, while disadvantages may include the crowding out of domestic industries and job outsourcing.
- **Total final energy consumption**: The total amount of energy that is readily consumed by end users, which include households, transportation, industry and agriculture. Final energy consumption excludes the energy used by the energy sector to transform resources into energy that is ready for consumption.
- **Trademark**: A unique combination of letters, words, sounds, or symbols that distinguishes the goods and services of a company from those of its competitors. Trademarks are considered a form of intellectual property.

2 Living and working

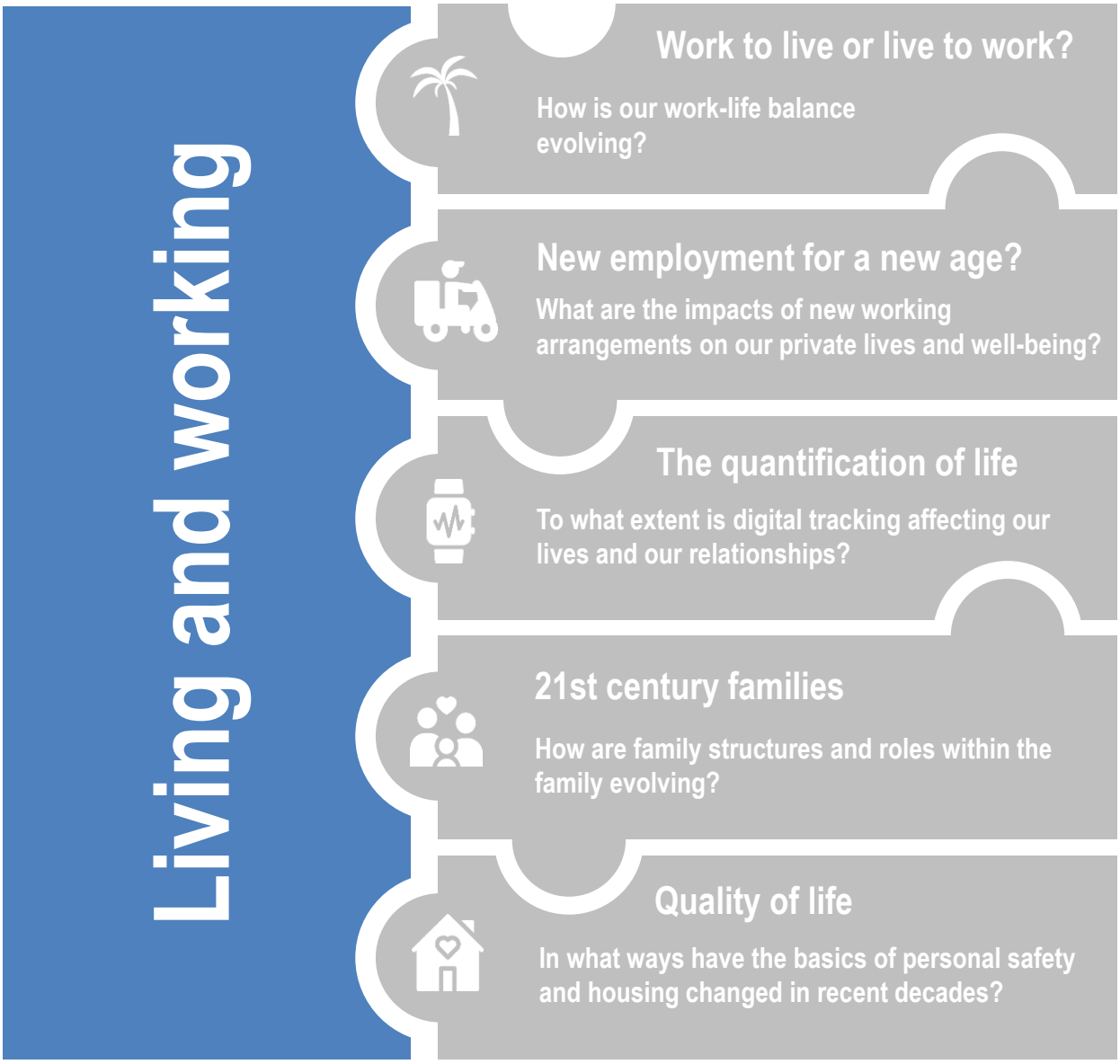
Our everyday lives are changing, both at work and at home. Education can continue to help us grow personally and professionally. But what future do we see for ourselves and our communities? This chapter explores these issues through five themes:

- **Work to live or live to work?**: looks at trends in working hours and time off work.
- **New employment for a new age?**: examines the rise of non-standard forms of work, such as temporary employment and digital freelancing.
- **The quantification of life**: explores how we relate to ourselves and others through digital tracking and relationships.
- **21st century families**: illustrates changes in family structures and the evolving distribution of reproductive and caring tasks at home.
- **Quality of life**: examines our quality of life through personal safety and housing conditions.

These trends are linked to education and its future through a series of questions and scenarios. Potential implications of COVID-19, both immediate- and longer-term, are discussed.

Overview and impact of COVID-19

Both our working and private lives are evolving. On average people are working fewer hours than a century ago, and flexible work, such as part-time or telework, is more common. These changes open up new possibilities but also come with risks, for example greater job instability and precariousness. Beyond the world of work, digital technologies are changing the way we relate to ourselves and others, from tracking our daily steps to organising our love life. In many respects, communities are becoming safer, although differences persist in terms of income, age and gender. At home, family structures are continuing to evolve and slow, yet firm steps towards greater gender equality are visible. From early childhood through to lifelong learning, education can play a role in helping individuals thrive in a rapidly changing economy and society, promoting safe, healthy and caring individuals and communities.



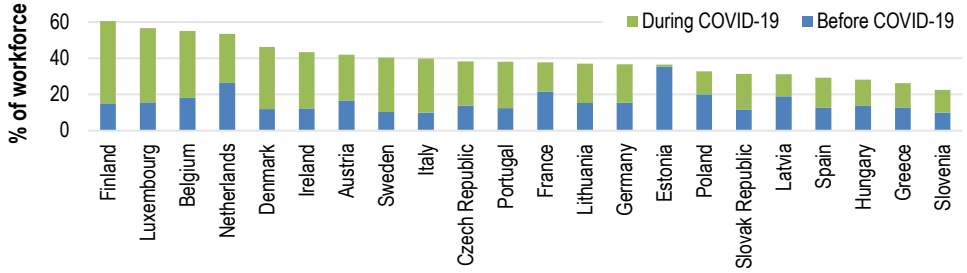
Living and working & COVID-19

The COVID-19 pandemic is a reminder that, despite our best laid plans, the future likes to surprise us. Trends can accelerate, bend and break. As the shock subsides, open and important questions emerge about the long-term effects of these shifts.

ACCELERATE

The great disruptor: Will telework be the new normal?

People working from home before the pandemic and because of it



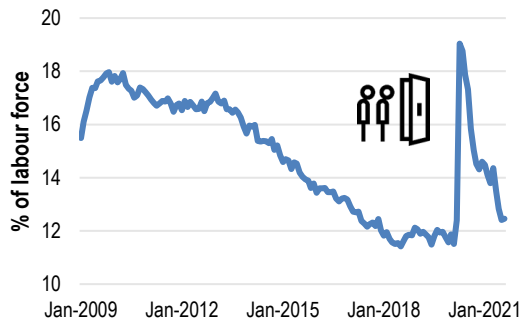
OECD (2021), https://www.oecd.org/global-forum-productivity/

BEND

What will the lasting impact be on youth employment, well-being and resilience?

The COVID-19 crisis undid ten years of progress on youth employment. As the crisis abates, youth unemployment seems to be recovering, but the longer-term impacts are not clear.

Unemployment rate for 15-to-24-year-olds, January 2009 - August 2021



OECD (2021), https://doi.org/10.1787/997c8750-en

BREAK

Will recognition of *essential* workers last?

COVID-19 spurred a debate about the public value and recognition of certain occupations. Healthcare professionals, caregivers, domestic workers, food producers and vendors, many of whom struggle with low pay and difficult working conditions, are now receiving higher recognition and support in many countries.

- Balcony spirit: solidarity with and gratitude to medical staff worldwide
- Agreements on salary increases, job creation and better conditions for health and care workers in countries like Belgium, Czech Republic, France, Ireland, Italy and Norway
- A first ever global Essential Workers Summit for a just recovery

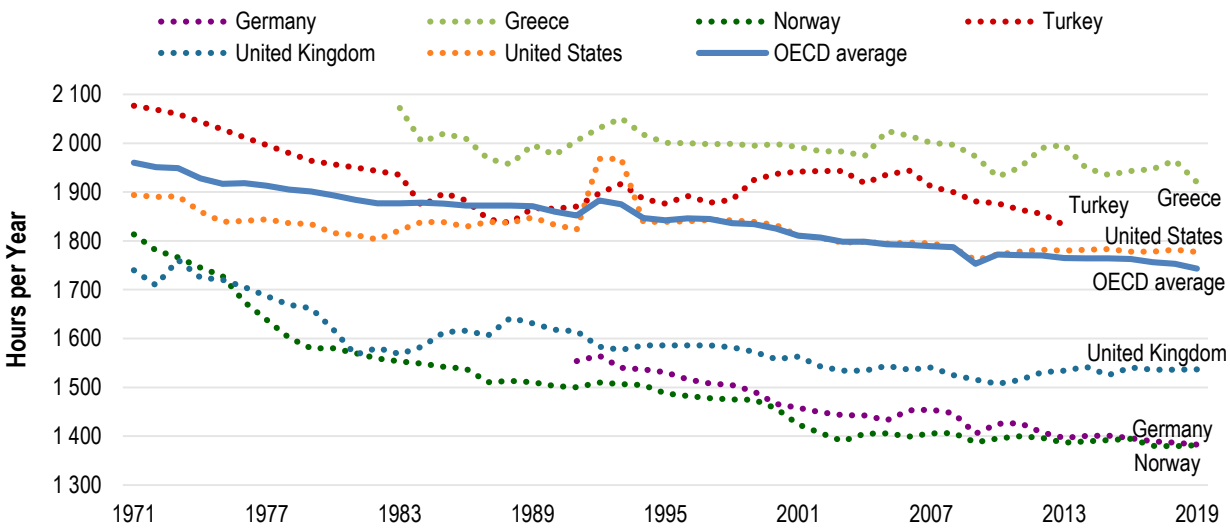
EPSU (2021), https://www.epsu.org/; https://essentialforrecovery.org/

Work to live or live to work?

Despite the impression that in today's busy world we work more than ever, working time has decreased steadily in the last century. In 1870, workers across the OECD worked on average more than 3 000 hours annually, and weekends did not appear until the early 20th century. The reduction in working hours has been driven by various factors including dramatic increases in productivity, income, labour regulations and more affordable leisure. This has translated into a significant rise in time off work and vacations, as reflected in the expansion of tourism over time. However, averages mask large differences both across and within countries. What is the role of education in preparing for life outside work? To what extent will the decline in working hours fuel a rise in demand for learning?

Figure 2.1. In pursuit of a work-life balance

Average annual hours actually worked per worker, 1971-2019



Note: Average annual hours worked is defined as the total number of hours actually worked per year divided by the average number of people in employment per year. OECD average includes all member countries but Israel and Slovenia.
Source: OECD (2021), *OECD Labour Force Statistics* (database), https://stats.oecd.org/.

StatLi https://stat.link/6ktpmf

During the first half of the 20th century, new international conventions limited the workday and the working week to 8 and 48 hours respectively. By 1971, hours worked had declined to 1 960, eventually reaching 1 743 hours annually in 2019. Yet, large differences persist between countries, with employees in Colombia and Turkey working on average over 46 hours per week in 2019, compared to just under 30 hours per week in the Netherlands.

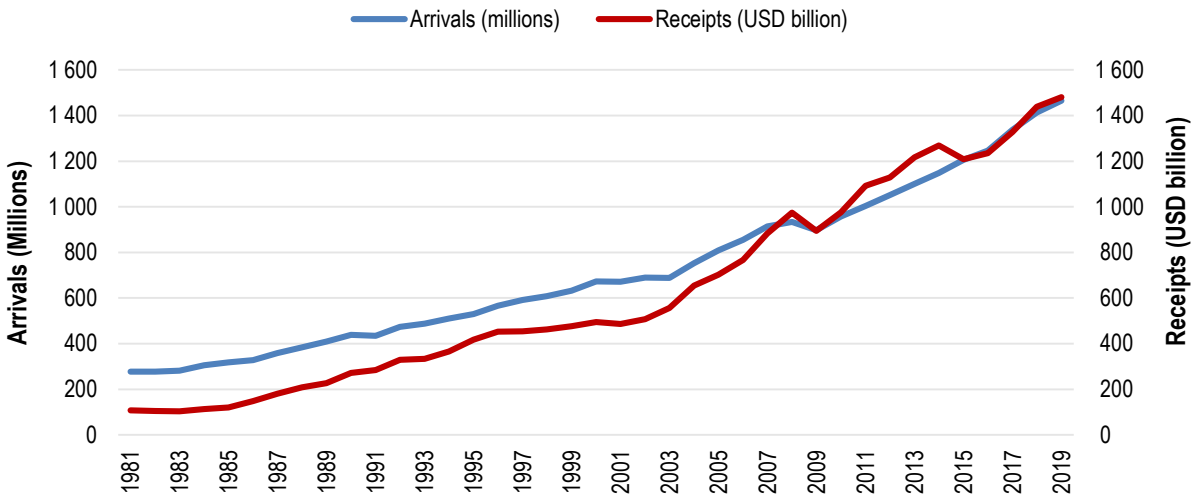
Differences are also significant within countries, for example with gender. Over 15% of male employees work very long hours (i.e. 50 or more per week) across the OECD, compared with about 6% of women. Additionally, evidence from the United States uncovers how work hours in the top tenth of the income distribution have actually risen since 1940, while workers in the bottom 60% witnessed a 20% decline of hours worked per week. Similar patterns have also been found in other OECD high-income countries.

At present, a full-time worker in the OECD spends on average 63% (or 15 hours) of the day on leisure and personal care, including eating and sleeping. Increasing time off work started gaining momentum in the interwar years, and in 1993, the European Union Working Time Directive established a minimum of 20 working days of paid vacations in EU member countries.

Across the OECD, minimum requirements for paid annual leave have been established in all countries except for the United States. Increased free time helps explain the continued expansion of tourism, which reached 1.47 billion international tourist arrivals in 2019. Between 2009 and 2019, real growth in international tourism receipts (54%) exceeded growth in world GDP (44%). This long-term growth has of course been interrupted by the COVID-19 pandemic: 2020 saw an unprecedented 73% drop in international tourist arrivals. While recovery is expected, many experts do not expect a return to 2019 international tourism levels before 2024.

Figure 2.2. Out of office

International tourist arrivals (millions) and tourism receipts (USD billion), 1981-2019



Source: World Tourism Organization (2021), Tourism Dashboard, https://www.unwto.org/global-and-regional-tourism-performance.

StatLink https://stat.link/57qm3v

And education?

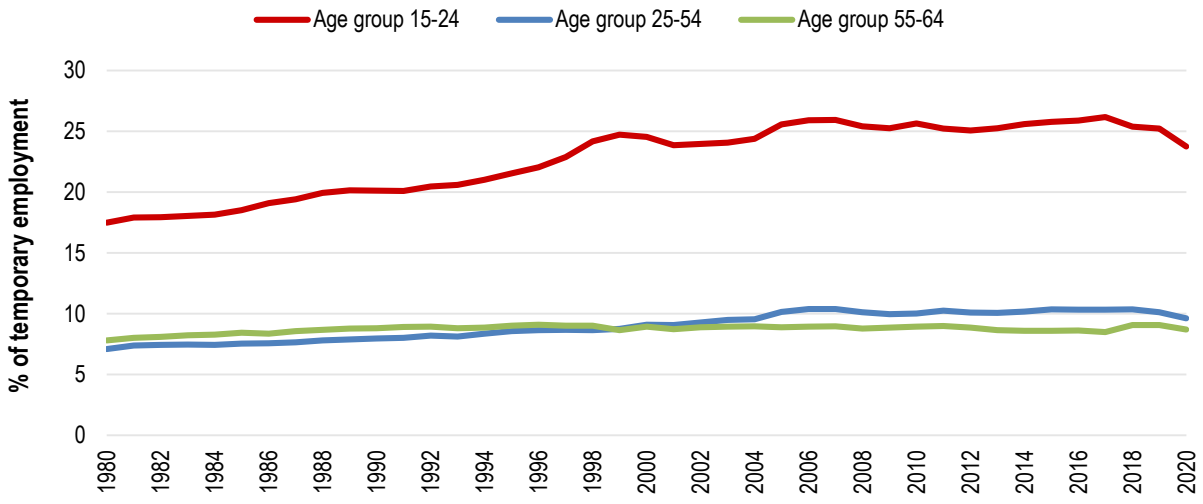
- In addition to work and studies, there is also leisure, family and political life, and more. Can education help individuals, young and old, to develop the competences needed to engage meaningfully across all aspects of life?
- Non-formal, informal and formal learning influence and reinforce each other. Is equitable access to non-formal learning, such as educational leisure, sufficiently considered in your system? What can education systems (local, regional, national) do to improve in this area?
- Despite an average fall in working hours, many parents across the OECD flag inconvenient timing and conflicting work hours as the main impediments for participating in school-related activities. What can schools and education systems more generally do to facilitate their participation?

New employment for a new age?

Labour markets are changing as new business models, job regulations and policies take hold. Non-standard forms of work, such as temporary and part-time employment, are on the rise. Digital technologies have enabled entirely new forms of non-standard work, notably remote work and jobs mediated by online platforms. While these new modes of labour can boost employment and offer more flexible and self-directed work arrangements, they may also give rise to unpredictable working patterns, intensifying work demands and blurring the lines between employment and private life. Robust lifelong learning systems will be essential to support the adaptability and resilience required to navigate the future of work.

Figure 2.3. The age of precariousness

Share of temporary employment by age group, OECD average, 1980-2020



Note: Temporary employment is part of dependent employment.
Source: OECD (2021), *OECD Labour Force Statistics* (database), https://stats.oecd.org/.

StatLink https://stat.link/aicedh

Non-standard work now encompasses over a third of the entire labour force in most OECD countries, impacting young workers the most. In 2020, temporary employment accounted for 24% of dependent employment for those aged 15-24, compared to 11% for the general population. This corresponds to a 7% increase for 15-24 year-olds compared to 1980. Part-time contracts have also been rising over the last two decades, particularly among young workers.

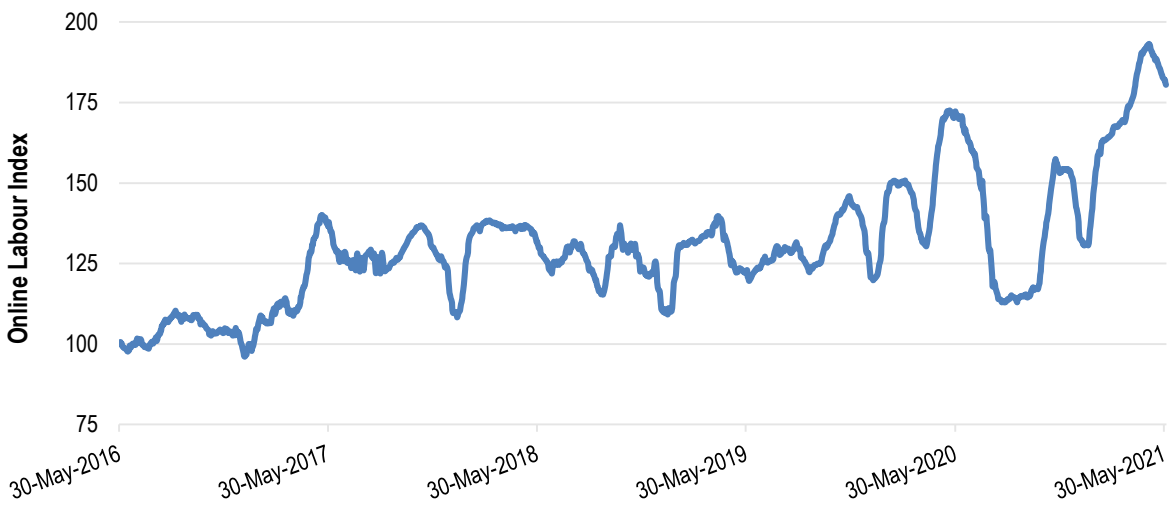
Non-standard work may lead to poorer quality jobs and reduced well-being for workers (especially for those with low and middle skills), due to greater job instability, lower wages, weaker social benefits and protections as well as fewer opportunities for training and promotion. It also heightens the risk of falling into income poverty, increasingly common among young adults nowadays, often dubbed the *working poor*.

Digital technologies are an important driver of change. The “gig economy”, where workers match themselves with customers via websites and apps, embodies the digital spread of non-standard work. While estimating the numbers of the gig economy is difficult, the global demand for online freelancing has almost doubled in the last five years, growing 11% annually from 2016 to 2021.

Yet despite increased efficiency, productivity and flexible working schedules, the gig economy arguably commodifies work. For some workers, it could signal a return to the informal and casual labour structures of the past, characterised by weak social and employment protection and poor working conditions. There is thus growing demand for better policy to regulate this new economy, to fully harness its potential while mitigating risks. Education and training systems can upskill and reskill people for a dynamic, constantly changing world of work, allowing everyone to learn, lifelong and life-wide. But how well are they meeting this goal? Is there more education should be doing?

Figure 2.4. Digital Taylorism

Online Labour Index (OLI), May 2016-May 2021



Note: The OLI tracks the number of projects and tasks across platforms, countries and occupations in real time. It does not estimate absolute numbers of gig workers, as it does not cover work obtained online and carried out locally, like delivery. See StatLink for full information.
Source: Kässi, O., C. Hadley and V. Lehdonvirta (2019), *Online Labour Index: Measuring the Online Gig Economy for Policy and Research*, figshare Dataset. https://doi.org/10.6084/m9.figshare.3761562.v1842.

StatLink https://stat.link/l0sy95

And education?

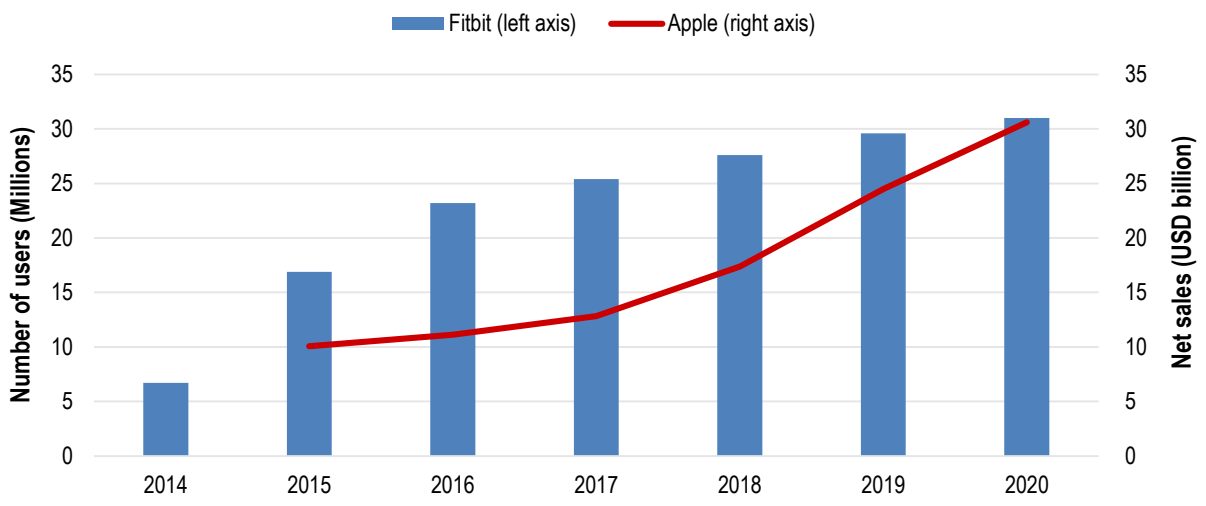
- With rising forms of non-standard employment, how do we structure our days if schedules are not given to us by our work organisations? How can education support children and adults in learning how to manage their time?
- Given the changing world of work, education systems are increasingly expected to prepare people for multiple jobs over their life course. Are they achieving this goal? If not, what should they start and/or stop doing?
- What are the consequences for on-the-job learning and training if increasing numbers of workers have no permanent fixed employer to sponsor such education? What does this shift mean for education systems, formal or non-formal, and for education professionals? What is the potential of new training opportunities emerging from the gig economy, such as peer networks and crowd-curated resources, to fill this gap?

The quantification of life

Individuals are increasingly focusing their free time on productivity, efficiency and self-improvement. Thanks to wearable tech and the ever-expanding Internet of Things, we can now distil parts of our life story down to data harvested on our smart devices. And the trend does not stop with our health: now even love and relationships are increasingly the product of algorithms. Once the realm of the individual (or family), our private lives are increasingly quantified and commodified by the same companies that extract value from the data we produce. Education helps develop the critical thinking necessary to make informed choices, as well as support and empower students of all ages to choose their own authentic path in an increasingly quantified society.

Figure 2.5. An app a day keeps the doctor away?

Fitbit active users (2014-2020) and Apple wearables, home & accessories net sales (2015-2020)



Note: Active Fitbit users are those who use their device (at least) once a week. Apple net sales include sales of AirPods, Apple TV, Apple Watch, Beats products, HomePod, iPod touch and other Apple-branded and third-party accessories.
Source: OECD calculations from Fitbit full year results (2014-2020), https://investor.fitbit.com/, and Apple annual reports on Form 10-K (2015-2020), https://investor.apple.com/.

StatLink https://stat.link/iabs48

Smart and wearable technologies are ubiquitous and increasingly part of our lives. Thousands of mHealth (mobile health) apps are available for download on smartphones, wearable devices and other tech gadgets. The list of things these tools can measure continues to grow, including breathing and heart rate, oxygen saturation, hours slept, calorie intake and physical activity. The number of Fitbit active users grew from 6.7 million in 2014 to 31 million in 2020; an explosion that epitomises the momentum of the self-monitoring phenomenon, also known as self-quantification.

Interestingly, monitoring aspects of one's life in the quest for self-knowledge is not a new practice, as illustrated by age-old strategies like journaling. Yet, digital technologies have enabled us to reach unchartered waters: a growing number of people regularly engage in building self-knowledge through numbers with the goal of improving physical, mental and emotional performance.

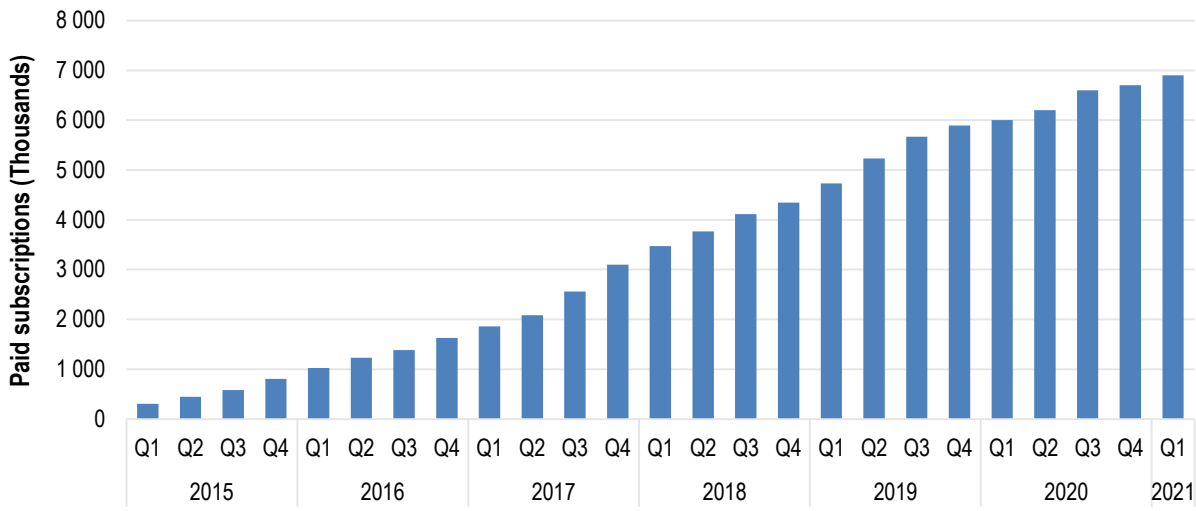
Amidst the progressive quantification of life, even love and relationships are increasingly transformed into products of algorithms. The number of paid subscriptions to the dating platform Tinder skyrocketed from 304 000 to almost 7 million in five years. It is estimated that Tinder currently has over 66 million monthly

users - a true mass phenomenon. Through such dating apps, the dating scene becomes a market, a place to shop for potential partners like items in a catalogue. Given the endless alternatives available, romantic relationships may increasingly resemble commodities to be consumed quickly and en masse, while encounters become economic transactions.

Is this just the “new normal”? Digital, data and health literacy is key to identifying and raising awareness of the increasing 'datafication’ of everyday life and associated risks.

Figure 2.6. Love at first swipe

Tinder average paid subscribers, 2015-2021(Q1)



Source: OECD calculations from Match Group Investor Presentation (2015-2019) & 2020-2021 Quarters Result https://ir.mtch.com/overview/.

StatLink https://stat.link/s2dukl

And education?

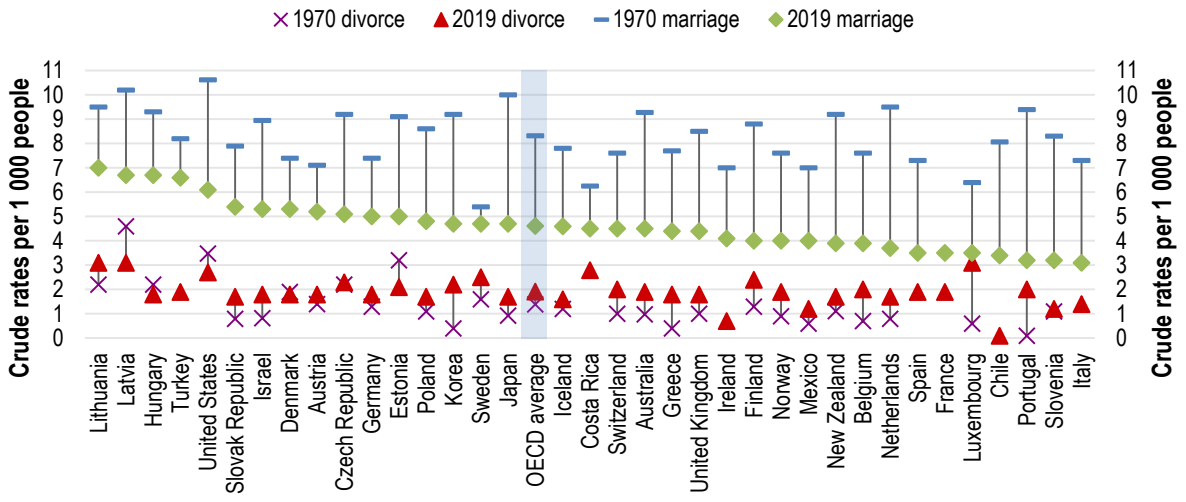
- Many aspects of education are being increasingly measured and quantified. Are we reducing education only to quantifiable things? If we can’t measure it, will it still count?
- Do education institutions have the capacity to understand and use the data that are generated by digital tools, platforms and services? If not, what could help? Strengthening teachers’ data literacy? Introducing and integrating new professional roles in schools and universities?
- Increasing quantification of life is linked to a growing expectation of perfection – in education, appearance, relationships, and life more generally. What is the best way to empower learners to resist this pressure? How can education help not only address but also prevent potential negative consequences (e.g., increasing stress and anxiety; and reduction in risk-taking due to fear of making mistakes)?

21st century families

Family structures continue to evolve across OECD countries. The institution of marriage is evolving, for example, with declining marriage and fertility rates, increasing divorce, and the average age of marriage delayed until later in life. But romance is not dead: long-term partnerships, like cohabitation and civil unions have become more common. These changes reflect shift in social values, but other factors reinforce these trends such as increasing labour force participation of women, greater job instability and economic insecurity. Despite these shifts, certain family features are slow to change. Women still bear the brunt of reproductive and child-rearing work, balancing between work at the office and at home. Education policy can help build communities where all members are cared for and gender stereotypes fought.

Figure 2.7. Till death do us part

Crude marriage and divorce rates per 1 000 people, 1970 and 2019



Note: Data for New Zealand include civil unions. Where data were unavailable, figures from the closest year are used. See StatLink for details.
Source: OECD (2021), *OECD Family Database*, https://www.oecd.org/els/family/database.htm; for 2019, data from the respective national statistics offices have been used to produce this figure.

StatLink https://stat.link/pwn8yh

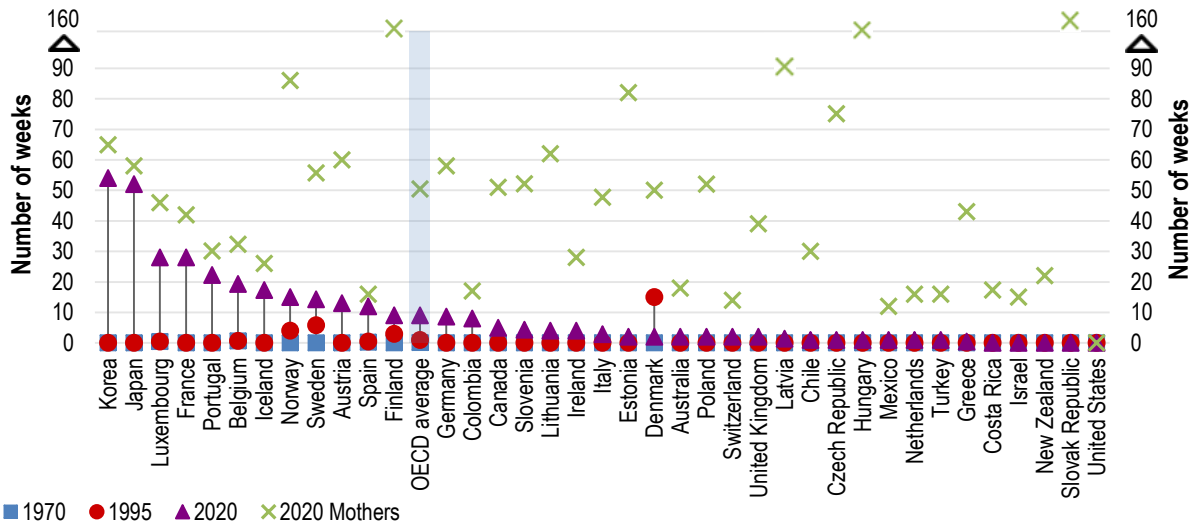
Marriage rates have been declining across the OECD over the past 50 years, from just over 8 marriages per 1 000 people in 1970 to less than 5/1 000 in 2019 on average. People are also marrying later: the average age of marriage rose by five years for both sexes between 1990 and 2017, to 30 years for women and 33 for men. In parallel, divorce rates have been rising in all countries except for Denmark, Estonia, Hungary, Latvia and the United States. Cohabitation has become correspondingly more common, with almost 10% of individuals in a cohabiting couple on average across the OECD. This is particularly popular in the Nordic countries: in Sweden, for example, 20% of couples live together without being formally married. An institution in transition, marriage itself has also changed and modernised, with same-sex marriage being legalised in 21 OECD countries as of 2020.

While marriage is evolving, other family matters are slow to change. Women still spend twice as much time in unpaid and care work as men across the OECD, with tasks such as cooking, cleaning, caring and shopping taking on average four-and-a-half hours of their time every day. To address this, many countries have expanded paid paternity, parental and home care leave for fathers over the last three decades – increasingly preventing leave entitlements from being transferred to the mother. Despite these efforts, in

2020 father-specific entitlements were still far shorter than those for mothers (9 versus almost 51 weeks on average across the OECD). Japan and Korea have the most generous allowance, where fathers are entitled to up to one year of paid leave. But uptake of parental and home care leave – aimed at childcare – remains low OECD-wide, with men making up only about one in every five users. This ratio is even lower in Korea, despite the generous allowance: Korean fathers make up less than one in every ten users. Fathers' involvement in childcare can positively impact child development, and improve educational outcomes and career expectations, especially for girls. Positive attitudes towards care, irrespective of gender, can be modelled and fostered in education from an early age.

Figure 2.8. Man of the house?

Length of paid paternity/maternity, parental and home care leave reserved for fathers (1970, 1995 and 2020) and for mothers (2020)



Note: Information refers to entitlements that can be used only by fathers and cannot be transferred to mothers, and any weeks of sharable paid leave that must be taken by the father in order for the family to qualify for 'bonus' weeks of parental leave. OECD average includes 38 countries.
Source: OECD (2021), *OECD Family Database*, https://www.oecd.org/els/family/database.htm.

StatLink https://stat.link/3i4tgy

And education?

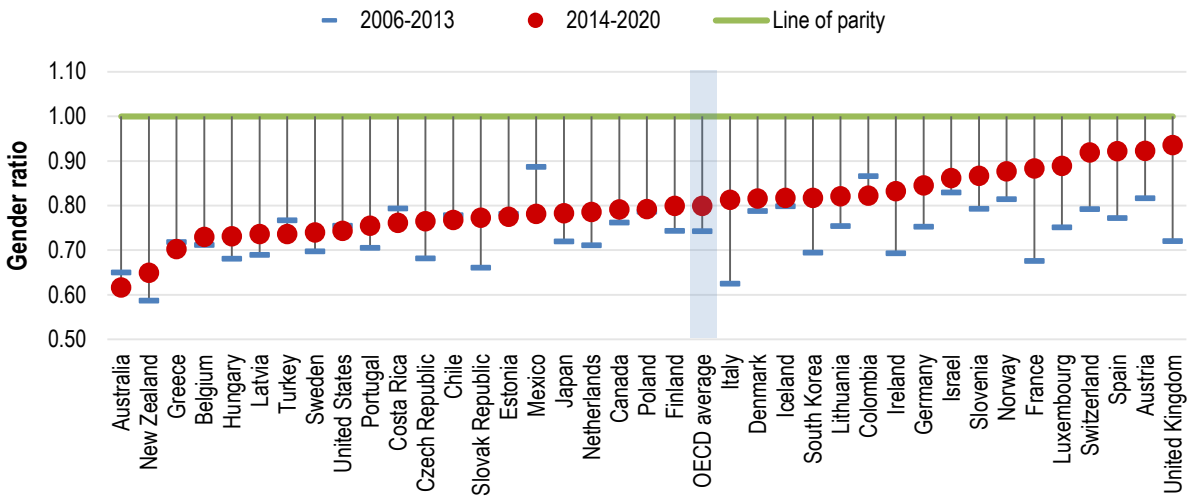
- Where do we draw the line between family and school responsibilities (care, teaching and learning, etc.)? Are the different roles reflected in education policies, such as those governing school schedules and resourcing?
- How can education systems, including adult education, help challenge gendered care roles and aspirations? By promoting more balanced role models? Changes in curricula? In the composition of the teaching workforce?
- Access to high-quality early childhood education and care is associated with higher school achievement and life outcomes. It is also a key support structure for working parents. How can governments ensure that it is accessible to all, especially the most disadvantaged?

Quality of life

People's quality of life has improved in recent decades on several measures. *Across the OECD, homicide rates and road fatalities have decreased, and people feel safer when walking alone at night in their neighbourhoods. Satisfactory housing conditions have also improved, with overcrowding and the share of households lacking basic sanitation decreasing on average. Nevertheless, major inequalities persist and even grow. Personal safety varies substantially across countries and different gender, age and education groups. And despite improvements in housing conditions, housing affordability is still a serious problem. How can education serve all learners, including those facing circumstances that are more difficult?*

Figure 2.9. Strangers in the night

Gender ratios for people who feel safe walking alone at night in the area where they live, 2006-2013 and 2014-2020



Note: Gender ratios are calculated by dividing the share of women who feel safe walking alone at night, by the share of men who feel safe.
Source: Gallup (2021), *Gallup World Poll* (database), www.gallup.com/services/170945/worldpoll.aspx.

StatLink https://stat.link/vws1z7

Safety, or its absence, has far-reaching consequences for well-being. On average across the OECD, homicide rates have fallen by 33% since 2010, and road fatalities have dropped by over 20%. In 2020, around 74% of people reported feeling safe when walking alone at night in their neighbourhood, up from 66% in 2006. Yet, significant differences exist across countries and between population groups. For example, those aged 30-49 and university educated are more likely to feel safe.

From a gender perspective, men feel safer than women when walking alone at night in all OECD countries – on average, eight in ten men compared to six in ten women. The gap is particularly high in Australia and New Zealand: around 80% of men feel safe compared to around 50% of women. Yet, the gender gap in feelings of safety has narrowed slightly between 2006-13 and 2014-20 in several OECD countries – notably in France, Italy and United Kingdom.

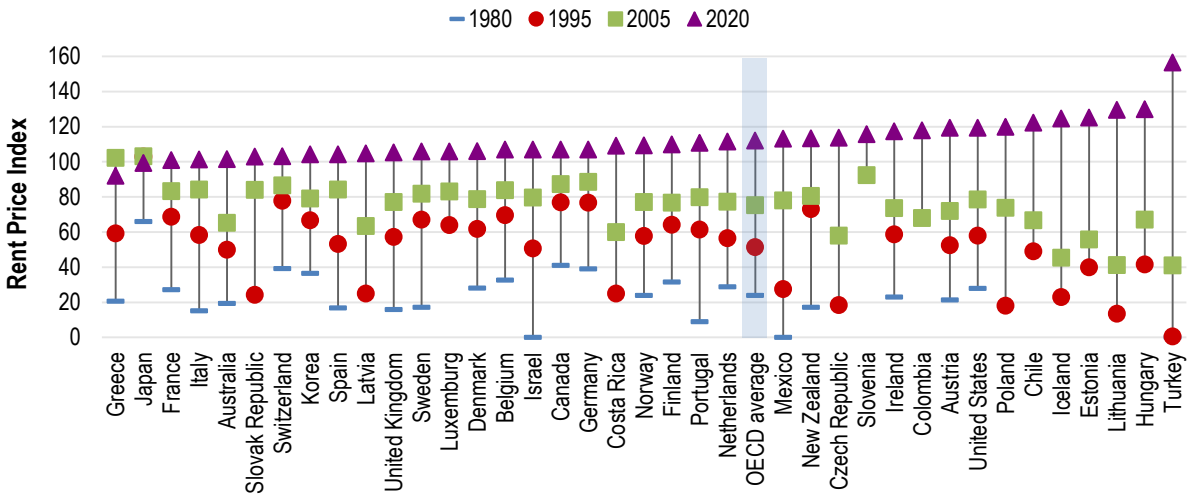
Households are dedicating an increasingly large share of their disposable income to housing, due in part to rising housing prices, especially for renters. Higher prices hamper consumption and saving abilities, making people more vulnerable to economic shocks. Between 1980-2020 rents increased on average more than 350% across OECD countries. Since 2005, rents have more than doubled in Estonia, Iceland, Lithuania and Turkey. These trends disproportionately affect the poor. Nearly three in ten households in

the bottom 20% of the income distribution spend on average over 40% of their disposable income on rent or mortgage payments. They are also more likely to live in poor quality and overcrowded dwellings.

This financial burden can ultimately lead to eviction or even homelessness: prior to the COVID-19 pandemic, over 3 million formal eviction procedures had been initiated in the OECD and homeless rates had been rising in one-third of OECD countries, affecting over 2 million people. Education, together with other social services, must work to support healthy development for all students, removing learning barriers within schools and classrooms – and, with the rise of digital learning, beyond them as well.

Figure 2.10. How (un)affordable is your home?

Rent Price Index (2015=100), 1980, 1995, 2005 and 2020



Note: Where data were unavailable, figures from the closest year are used. See StatLink for further detail.
Source: OECD (2021), "Housing prices" (indicator), https://doi.org/10.1787/63008438-en.

StatLink https://stat.link/k901j8

And education?

- Emotional and physical safety are key for learning and healthy development. How can schools and communities work together to ensure student safety? How can education systems better prepare and support teachers in doing this?
- Residential segregation is a key driver of school segregation, hindering education's quality and equity. Which enrolment and resourcing policies mitigate the effects of and reduce segregation in education systems?
- Learners come to education from different and evolving family and housing circumstances. What are the implications of remote and hybrid learning for different student groups? How can time, spaces and people be reorganised to support the diverse needs of students and families?

What future for living, working and education?

Trends allow us to consider what current patterns might mean for the future. But what about new patterns, shocks and surprises that could emerge over the next 15 to 20 years?

Building on the OECD Scenarios for the Future of Schooling, this section encourages readers to consider how growth could connect with education to evolve in multiple ways. Two vignettes illustrate possible stories: the Reader is invited to adapt and create new ones as desired. The next page sets out some key questions for education, and a set of potential shocks and surprises that could impact education and learning in unexpected ways. The descriptions of each scenario can be found in the Introduction of this volume.

Scenario 1 Scenario 2 Scenario 3 Scenario 4

Tracey is the founder and CEO of Academy, a virtual learning platform for children of digital nomads. Ever since remote working became the default, digital nomadism has exploded. "You are now free to work for a company in London while living in Rio. And next year you can decide to move to Stockholm," Tracey explains to the investors, "but what about your child's education?" Academy provides personalised learning tracks for children as young as five, with 80% of courses delivered online and 20% in partnership with local schools all over the world. Tracey is now looking for new funds to expand the local schools network in Latin America. If she succeeds, the company will be included in the Future 500 list of best educational providers for 2040. "And then? Maybe the moon!"

Ever since the 25-hour working week was introduced as part of the Ministry of Possibilities' quality of life reform package, Cat, a well-known sustainable fashion designer, has plans to welcome her daughter's class in the atelier every Thursday. "I haven't tried teaching yet, this is going to be tons of fun", she announces proudly. For a month, the students will learn how a wide array of everyday materials can be re-used to build innovative textures and get to test out their own designs. At the end of the term, their work will be exhibited at the local Museum of Craft and Design, and Cat will offer apprenticeship positions to students inspired to continue learning. "I'm happy for you" says Cat's daughter over dinner. "But please, don't tell anyone you're my mom, ok?"

In 2040, things look quite different

Qualification, socialisation, care and credentialing arrangements may differ across alternative futures.

By 2040, how could the goals and functions of education be impacted by changes in:

- the world of work?
- family life and personal self-realisation?
- poverty and social exclusion?

What is expected from education?

Changing values, science and technology shape learning. In 2040…

- where does learning happen (home, school, work-place, etc.)?
- do curricula support self-achievement and entrepreneurship (among others)?
- how is learning/work balanced with play/leisure?

How are space, content, time and relationships organised?

Who educates and in which conditions?

By 2040…

- are teaching activities and profiles more or less diverse?
- is teaching based on professional standards or is it more open access?
- do educational settings, such as nurseries, schools and universities, still exist in a physical format?

Who is responsible for what and accountable to whom?

Views on education differ across stakeholders, and so does their capacity to influence decisions. In 2040…

- what are the roles of government, market and civil society?
- is decision making transparent? Is it inclusive?
- in which ways does the geopolitical context affect the provision of education and learning?

Shocks and surprises

Despite the best laid plans, the future likes to surprise us. What would these shocks mean for education and learning if they came to pass? Can you see signs of other potential disruptions emerging?

Virtual reality is the reality

With advances in virtual reality and haptic technologies, the majority of human activity, including both work and leisure, now takes place in the virtual space

De-urbanisation / de-localisation

Thanks to teleworking, physical location no longer matters: the middle class has left urban areas and cities are underserviced areas for the poor

New pandemics

Everyone is a potential threat since both manufactured viruses and breaks in the dormancy of pathogenic bacteria have generated a persistent risk of epidemic outbreaks

Friends are the new family

Rising house prices and changing family structures have resulted in widespread cohabitation arrangements, transforming childcare and parenting practices

Find out more

Relevant sources

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Glossary

- **Civil Unions**: Legal recognition of the committed partnership of two individuals. Typically, the civil registration of their commitment provides the couple with legal benefits that approach or are equivalent to those of marriage.
- **Cohabitation**: People who are living with a partner in a consensual union but who are not legally married to the partner and are not in a registered partnership with the partner.
- **Crude marriage (and divorce) rates**: Defined as the number of marriages (and divorces) during the year per 1 000 people.
- **Dependent employment**: Employment compensated by a wage or salary.
- **Eviction**: The process of the involuntary removal of people from rental dwellings, involving a judicial process in courts or other litigating bodies, such as landlord and tenant boards or rental housing tribunals. Evictions can also affect households in owner-occupied housing, especially households that fall behind on their mortgage payments.
- **Gig economy**: A way of working based on temporary jobs or doing separate pieces of work, each paid separately, rather than working for an employer. Gig (or platform) workers are individuals who use an app (such as Uber) or a website (such as Amazon Turk) to match themselves with customers, in order to provide a service in return for money. They offer a diverse range of services including transport, coding and writing product descriptions.
- **Income poverty**: When the income level of an individual or household is so low that basic human needs cannot be met.
- **Internet of Things**: Refers to all devices and objects whose state can be altered via the internet, with or without the active involvement of individuals. It includes all kinds of objects and sensors that permeate the public space, the workplace and homes, and that gather data and exchange these with one another and with humans.
- **Leisure**: A wide range of indoor and outdoor activities, such as sports, entertainment and socialising with friends and family. Leisure excludes paid and unpaid work and personal care activities, such as eating and sleeping.
- **mHealth (mobile health)**: A variety of applications used on mobile and wearable devices to monitor health, treat disease and improve human health outcomes.
- **Non-standard dependent employment**: Refers to wage and salary workers working either on a part-time or on an unstable basis (i.e. involving frequent transitions between dependent employment and unemployment over a number of years).
- **Non-standard work**: All temporary, part-time and self-employment arrangements, i.e. everything deviating from the “standard” of full-time, open-ended employment with a single employer. As working from home does not take place at the employer’s premises, but rather at the worker’s home or at another location of their choosing, it too is considered a diverse employment arrangement.
- **Online freelancing**: Refers to individuals that find a job online and work via internet. It does not include work obtained online and carried out locally like delivery and ridesharing.
- **Overcrowded dwellings**: Living conditions where less than one room is available in each household: for each couple in the household; for each single person aged 18 or older; for each pair of people of the same gender between 12 and 17; for each single person between 12 and 17 not included in the previous category; and for each pair of children under age 12.
- **Paid annual leave**: A paid number of days each year that an employee is allowed to be away from work. Annual leave can generally be taken at the choice of the employee (albeit with the exact timing of the leave often made in agreement with the employer).

- **Paid home care leave**: Employment-protected leave of absence that sometimes follow parental leave and that typically allow at least one parent to remain at home to provide care until the child is two or three years of age. They tend to be paid only at a low flat-rate. They are also called childcare or child raising leave.
- **Paid parental leave**: Employment-protected leave of absence for employed parents that often supplements maternity and paternity leave and frequently, but not in all countries, follows the period of maternity/paternity leave. Entitlements to parental leave itself are often individual (i.e. each parent has their own entitlement).
- **Paid paternity leave**: Employment-protected leave of absence for employed fathers at or in the first few months after childbirth, or in some countries, adoption.
- **Personal care**: Includes time spent in activities required by the individual in relation to biological needs (sleeping, eating, resting etc.); performing own personal or household health care and maintenance or receiving this type of care; travel related to personal care activities in relation to spiritual/religious care; doing nothing, resting, relaxing; meditating, thinking, planning.
- **Remote work**: Carrying out work while remaining physically at home - or at another location - and not being present at the company's or at a client's premises during normal working hours, irrespective of whether it is occasional or regular.
- **Tinder**: One of the most famous online dating applications that allows users to anonymously swipe to like or dislike other users' posted profiles, which generally comprise their photo, a short bio and a list of their personal interests. Once two users have "matched", they can exchange messages.
- **Unpaid and care work**: Includes time spent in routine housework; shopping; care for household members; child care; adult care; care for non-household members; volunteering; travel related to household activities; and other unpaid activities. Care work refers to the provision of personal care but also the supervision and the education of a child, including reading and talking with children, as well as transporting children.
- **Wearable Tech**: A category of electronic devices that can be worn as accessories, embedded in clothing, implanted in the user's body, or even tattooed on the skin. The devices are hands-free gadgets with practical uses, powered by microprocessors and enhanced with the ability to send and receive data via the internet.

3 Knowledge and power

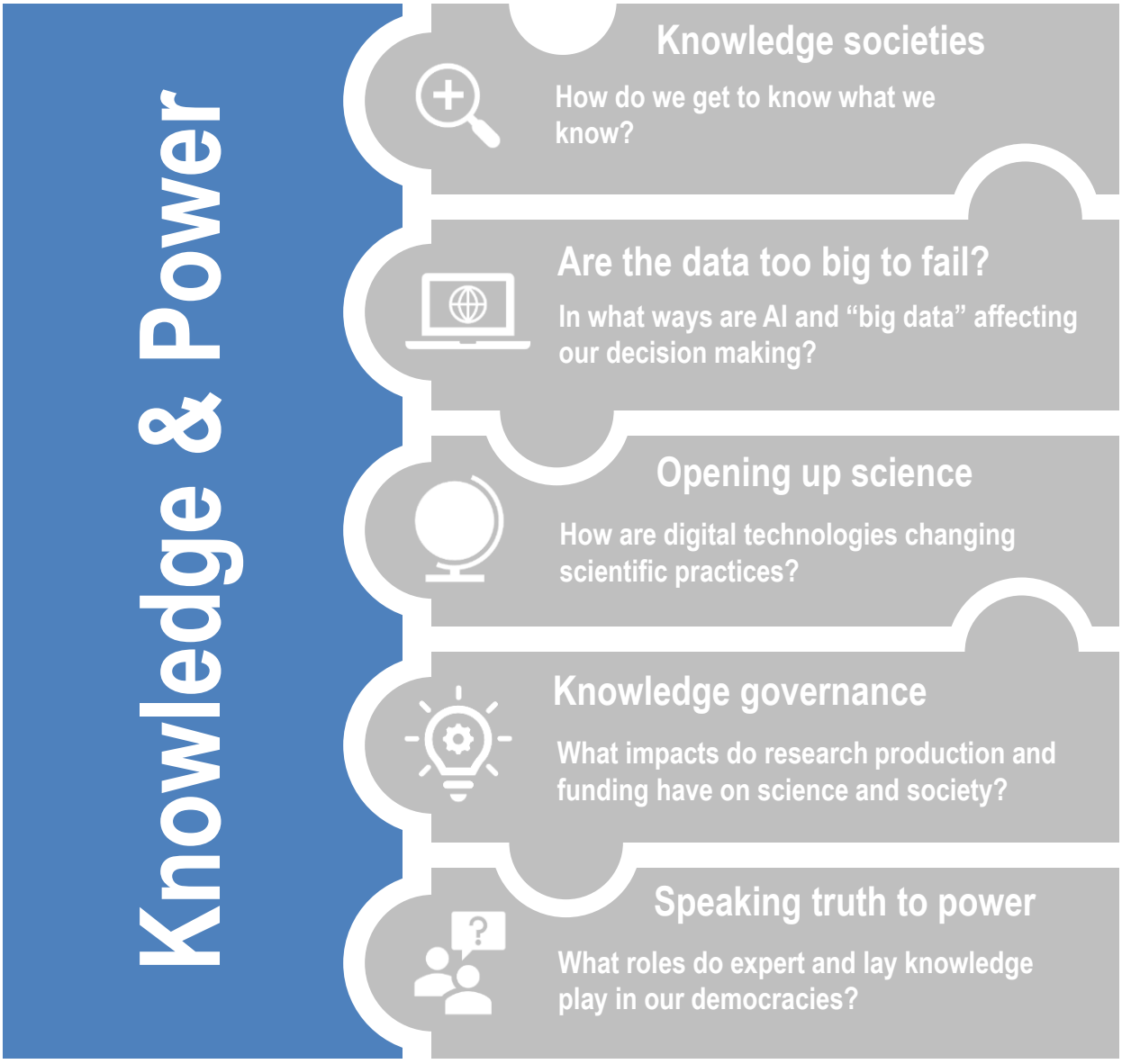
Scientific progress and research help us make decisions and solve problems, but they can also introduce new uncertainties. Education equips people with knowledge and helps reinforce the values and skills needed to make it meaningful in their own contexts. This chapter explores these issues through five themes:

- **Knowledge societies**: explores the expansion of knowledge production, distribution and use.
- **Are the data too big to fail?**: looks at Artificial Intelligence and data-driven decision making.
- **Opening up science**: highlights emerging forms of scientific production and dissemination.
- **Knowledge governance**: illustrates the expansion of research and how governments shape and promote it.
- **Speaking truth to power**: examines the role of expert and lay knowledge in current democracies.

These trends are linked to education and its future through a series of questions and scenarios. Potential implications of COVID-19, both immediate- and longer-term, are discussed.

Overview and impact of COVID-19

Knowledge production, like science and technology, and distribution, such as information and communication technologies, are ubiquitous. On the one hand, this entails new, powerful means to inform ourselves, make decisions and solve problems, from public policy to our everyday lives. On the other hand, it means new risks and uncertainties too, such as how to deal with abundant, sometimes fake or misleading information, or how to reap the benefits of a digitalised economy given rapidly emerging new jobs and markets. Today, governing information and knowledge effectively is central to both individuals and collectives. In education, key issues to look at include the changing nature of literacy in the 21st century, how to manage and produce research in a more open innovation environment, and how to prepare people for citizenship and democracy in a global and digital world.



Knowledge and power & COVID-19

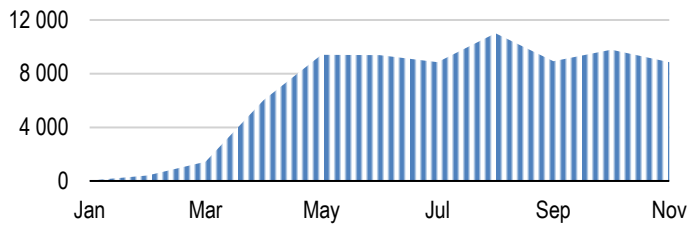
The COVID-19 pandemic is a reminder that, despite our best laid plans, the future likes to surprise us. Trends can accelerate, bend and break. As the shock subsides, open and important questions emerge about the long-term effects of these shifts.

ACCELERATE

Will the pandemic further accelerate open science trends?

Increased funding, open access and data, and fast-track publication accelerated COVID-19-related scientific production. Over three in four of all COVID-19 publications are open access.

COVID-19 biomedical and life sciences research publications, 2020

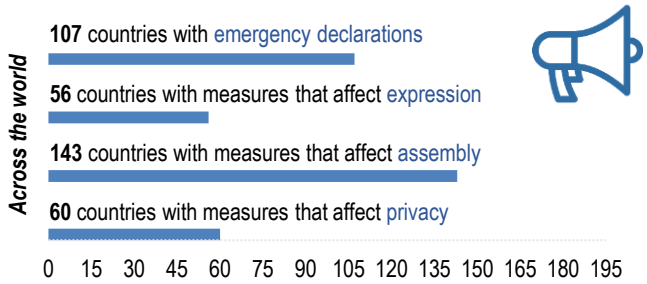


OECD (2021), https://doi.org/10.1787/75f79015-en.

BEND

Will democratic values and respect for the rule of law suffer?

Public health emergency measures disrupted key democratic traditions including suspended elections, mobility restrictions (lockdowns and curfews) and exceptional state powers of surveillance over citizens.

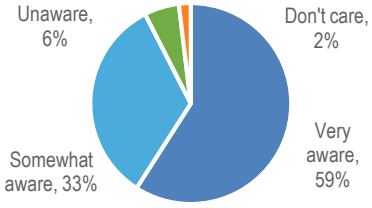


ICNL (2021), https://www.icnl.org/covid19tracker/.

BREAK

Will COVID-19's "infodemic" change how we deal with digital information?

COVID-19 'fake news' awareness in 24 countries, 2020-2021



Social media platforms and search engines aim to prevent the spread of false and misleading information by:

- Highlighting, surfacing and prioritising content from authoritative sources.
- Co-operating with fact-checkers and health authorities.
- Offering free advertising to public authorities.

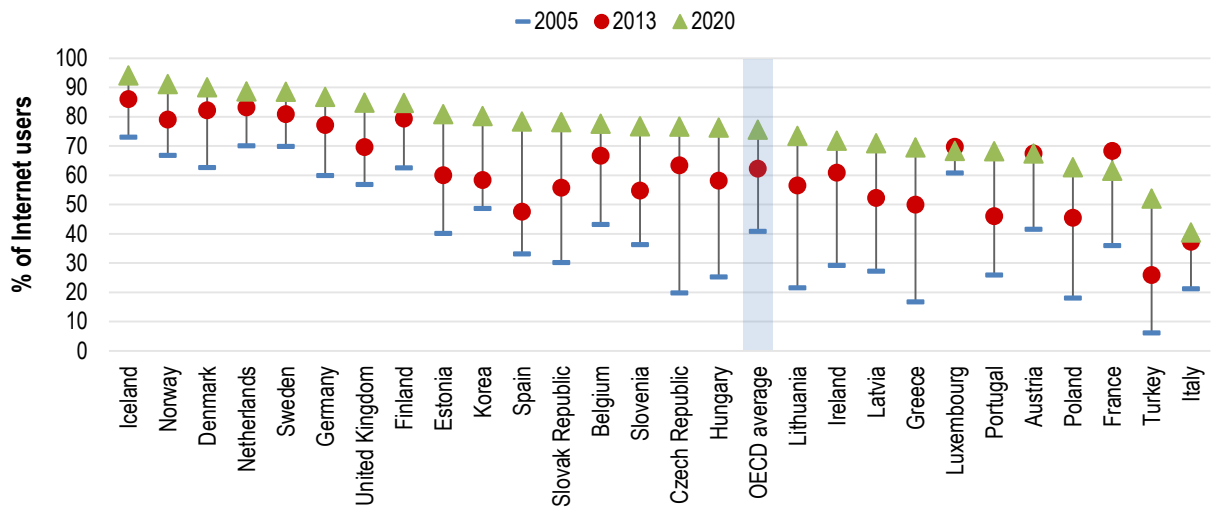
OECD (2020), https://www.oecd.org/coronavirus/; Social Media and COVID-19 (2021), https://www.covid19-infodemic.com/.

Knowledge societies

Historically, individuals and organisations struggled with a lack of information and knowledge. Today, we struggle to handle its abundance: endless information is now widely available and accessible through Wikipedia, Google and more. Many aspects of our lives depend on a number of technologies connecting multiple pieces of knowledge and the 'wisdom of crowds' to offer intuitive solutions at the point of use, from sophisticated transport infrastructure to the daily weather forecast. The finest medical advice, the best product among seemingly infinite alternatives… all these things we have at the tap of a finger. In education, this vast, distributed and readily accessible universe of knowledge triggers essential questions about access, literacy and equity. How do we support all individuals in not only accessing digital information, but knowing what to do with it when they have it?

Figure 3.1. An infinite library

Internet users using the internet (last three months) for finding information about goods and services, 2005-2020



Note: OECD average includes data for 27 OECD countries. Where the data for countries were not consistently available in the same years, figures from the closest year are used (see StatLink for full information).
Source: OECD (2021), *ICT Access and Usage by Households and Individuals* (database), https://stats.oecd.org/.

StatLink https://stat.link/mb28en

In 2005, about one in two individuals across the OECD used the internet regularly, and only one in three did so daily or almost every day. Of course, back then smartphones did not exist as we know them today, with their high-speed connectivity, intuitive interfaces and access to infinite apps. In 2020, about 80% of individuals used the internet daily or almost every day on average across the OECD. A closer look at digital activity shows that, in 2005, only 40% of internet users used their internet for obtaining information about goods and services. By 2020, these figures had almost doubled, up to 75% of internet users.

The unprecedented connectivity afforded by digital technologies is redefining the ways in which knowledge is produced and circulated. Whereas only an elite few produced traditional encyclopaedias or the mass media of the 20th century (newspapers, radio and TV), today's social media and internet sites like Wikipedia rely on the masses to generate content. For example, the number of pages in all wikis grew from about 10 000 to over 250 million in 20 years.

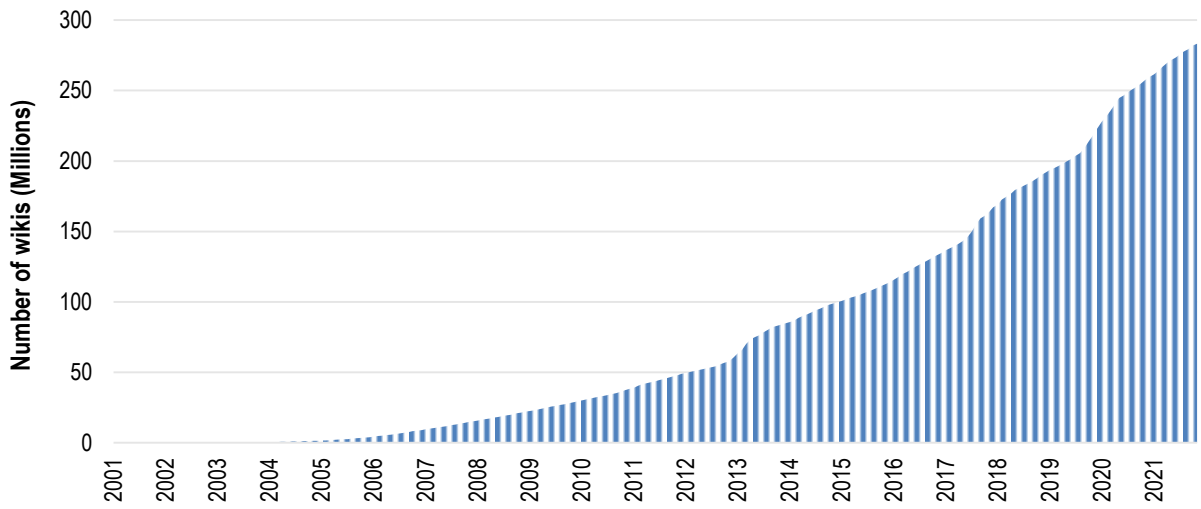
Wikis are just one example of the 'wisdom of crowds' on which we increasingly rely to make decisions. Other examples include how we use other people's reviews on the web to assess products and services

or digital videos to exercise and cook healthy meals. As digitalisation deepens, however, reaping its benefits is proving far more complex than just "pointing and clicking". The sheer range and volume of digital information demands ever-stronger abilities to select, evaluate and use it.

Today, high-quality education means fostering strong digital literacy; equipping all learners with the competences needed to search, evaluate and use information and knowledge – as well as actively creating and communicating in a variety of formats and platforms.

Figure 3.2. The wisdom of crowds

Number of pages in all wikis, 2001-2021



Source: Wikimedia (2021*), Pages to Date, All Wikis*, https://stats.wikimedia.org/.

StatLink https://stat.link/9i0zng

And education?

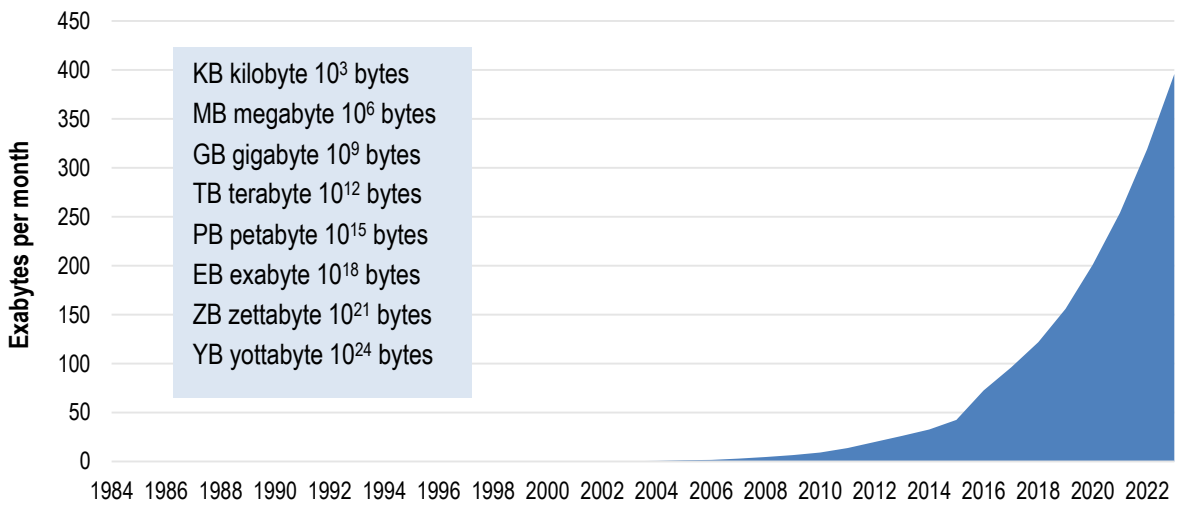
- The availability of knowledge does not guarantee access to it or the skills to use it. How can we support all individuals to access and use knowledge effectively? What types of education are needed to enable students, teachers and education leaders to effectively do so?
- Is more knowledge always better? What (digital) skills and attitudes are needed to effectively evaluate the quality and trustworthiness of information? To detect and discard poor quality, mis- and dis-information? How can we support teachers to validate the knowledge they use in their practice?
- Our social circles influence our access to knowledge – directly, as sources, and indirectly, by shaping our motivation to know, for example. Will strong digital competences be enough to ensure equitable access? Should educational institutions work more actively to strengthen (digital) social ties? If so, how?

Artificial intelligence: Are the data too big to fail?

From cave paintings to the printing press, humans have continuously expanded their capacity to record and communicate their understanding of the world. Digitalisation is the latest step in this history. With our increasing time online, the digital footprints we leave behind (on social media, smart devices or sensors) are being gathered, organised and analysed at an unprecedented scale. Artificial Intelligence (AI) systems are used to improve and, increasingly, automate decisions in fields as diverse as agriculture, health, marketing and criminal justice. Although powerful algorithms raise issues of ethics, transparency, accountability and privacy, the collaboration between humans and machines may make the difference in finding solutions to our greatest challenges. In education, digitalisation and AI hold the promise of supporting high-quality education through the personalisation of teaching and learning.

Figure 3.3. Our world in data

Global internet traffic, exabytes per month, 1984-2022



Note: Data for 2018-2022 are projections.
Source: Sumits (28 August 2015), "The history and future of internet traffic", https://blogs.cisco.com/, and Cisco (2016; 2017; 2018) Cisco Visual Networking Index, https://www.cisco.com/.

StatLink https://stat.link/u5lihg

Observations in science, accounting systems in business, and the population census in government exemplify how data have long powered knowledge- and value-creation in society. In the 21st century, our capacity to generate and collect data is rising exponentially, with each action online generating data traces that can be harvested and analysed. In 1984, global internet traffic was 15 gigabytes per month. Internet traffic surpassed the exabyte threshold in 2001, and the zettabyte threshold in 2017. The data from transactions, production and communication processes are then analysed to give birth to new products, processes, organisational methods and markets.

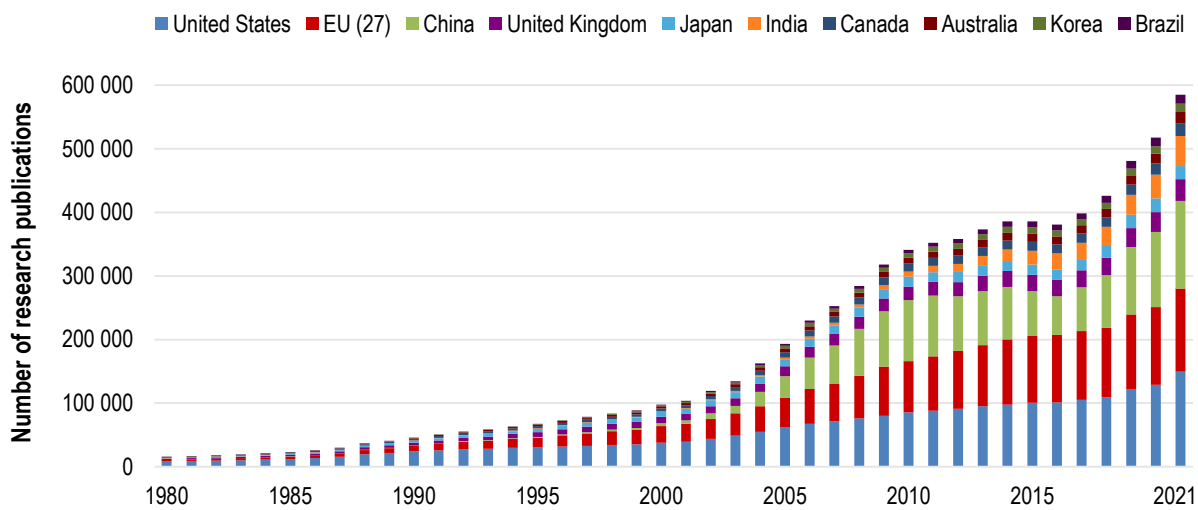
Yet, making sense of this plethora of data is not a given. Increasingly, AI systems help us navigate and extract patterns from data that are otherwise immense and unstructured. Data-driven predictions reduce uncertainty and inform decisions – for example, refining medical diagnoses or advertising through individual profiling. AI systems use increasingly sophisticated and automated statistical tools for their analyses. This raises concerns around the ethics and fairness of machine-based judgments – if the data on which algorithms rely are poor or biased, so too are the information and decisions arising from them.

Research on AI is on the rise: the number of AI-related research publications has been increasing steadily in the last 40 years. Since the turn of the century, the growth has exploded: from less than 100 000 publications to more than 550 000 between 2000 and 2021, with the United States, the European Union and China producing over 70% of the publications. The research identifies great opportunities, but also risks and existential questions.

Delivering on the promise of AI to augment human capacities, such as freeing up teachers' time to personalise education, will require addressing AI-related risks effectively. Yet, if the use of machine intelligence eventually outsources the process of knowing all together – that is, assimilating information and deploying it for us – bigger questions about human agency emerge.

Figure 3.4. The advent of smart machines?

Top producers of AI research worldwide by number of AI research publications, 1980-2021



Source: OECD.AI (2021), "AI Publication Time Series by Country" (indicator), OECD.AI Policy Observatory Live Data, https://oecd.ai/.

StatLink https://stat.link/3ew1h5

And education?

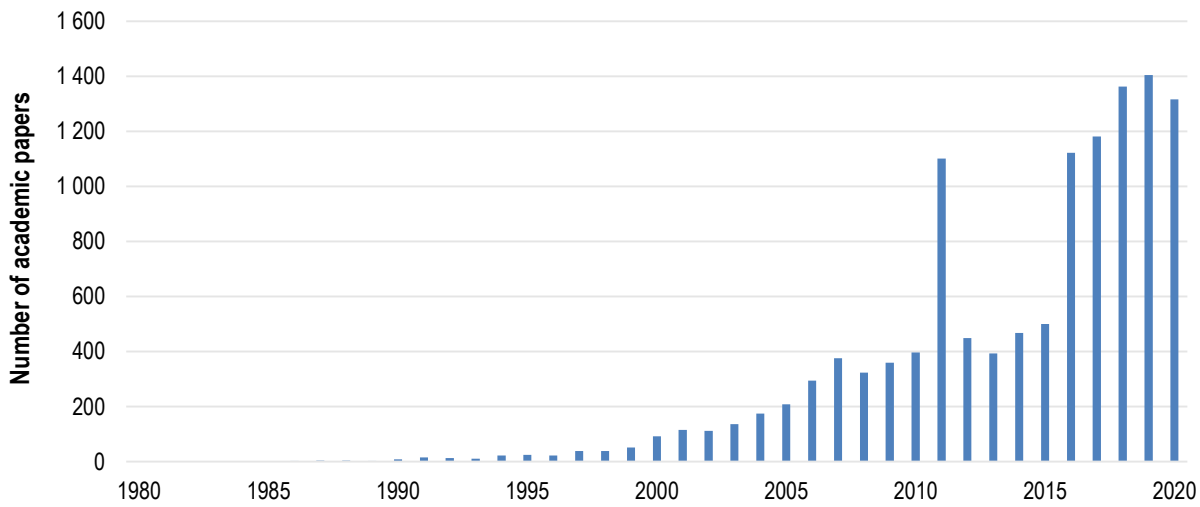
- Education is increasingly becoming digitalised and 'datafied'. What does this mean for the decision-making power of local actors (e.g. school leaders, teachers) compared to data owners/brokers (e.g. digital platforms and services)? Will power relationships between public and private providers of education shift?
- AI systems are increasingly being used to make decisions in education (e.g. student assessment, allocation of pupils into schools). How effective and fair have the outcomes been so far? Are we auditing these algorithms? Which situations should prioritise human intervention?
- What is the role of teachers in helping students understand the advantages, risks, threats and opportunities of AI? How should this topic be integrated in teacher education and professional development?

Opening up science

Science is a collective, cumulative and self-correcting enterprise. Scientific findings aren't trustworthy because they are uncontroversial, but because they are open to scrutiny and can be verified, revised and thus improved. Retraction of a publication is one example of science's internal quality assurance capacity. Both scientific malpractice and honest mistakes do exist, and the number of retracted scientific publications has risen over the past two decades, although they remain relatively rare. But science is not just a closed shop: digital technologies increasingly broaden access to and involvement in scientific publications and data to different stakeholders. Such efforts seek to keep improving the quality, integrity and legitimacy of scientific output. Opening up science can accelerate the translation of scientific findings into new ideas and products, which may in turn generate social and economic benefits.

Figure 3.5. Science is self-correcting

Rate of academic paper retraction, Web of Science, 1981-2020



Source: Sharma (2021), "Team size and retracted citations reveal the patterns of retractions from 1981 to 2020", https://doi.org/10.1007/s11192-021-04125-4.

StatLink https://stat.link/n8g06z

Science's trustworthiness relies on its methods. At the same time, from honest mistakes to plain fraud, a number of scientific malpractices exist, ranging from overselling results and data fishing to partial publication and fabrication of data. A study including over 12 000 papers indexed by Web of Science found that the number of retracted papers increased from less than 200 in the year 2000 to over 1 200 in 2020. However, scientific output has drastically increased over the same period, and a relatively small number of authors are responsible for a disproportionate amount of retractions.

Retraction of scientific publications is both proof that mistakes take place and that the research community has tools to identify and correct them. Scientific collaboration may help prevent malpractice, as no author wants his or her name associated with wrongdoings. Between 2001 and 2019, the cumulative number of journals that published at least one article disclosing its reviewers' identities, and/or their review reports of the article, grew from 38 to over 600, indicating a move towards greater academic transparency and accountability.

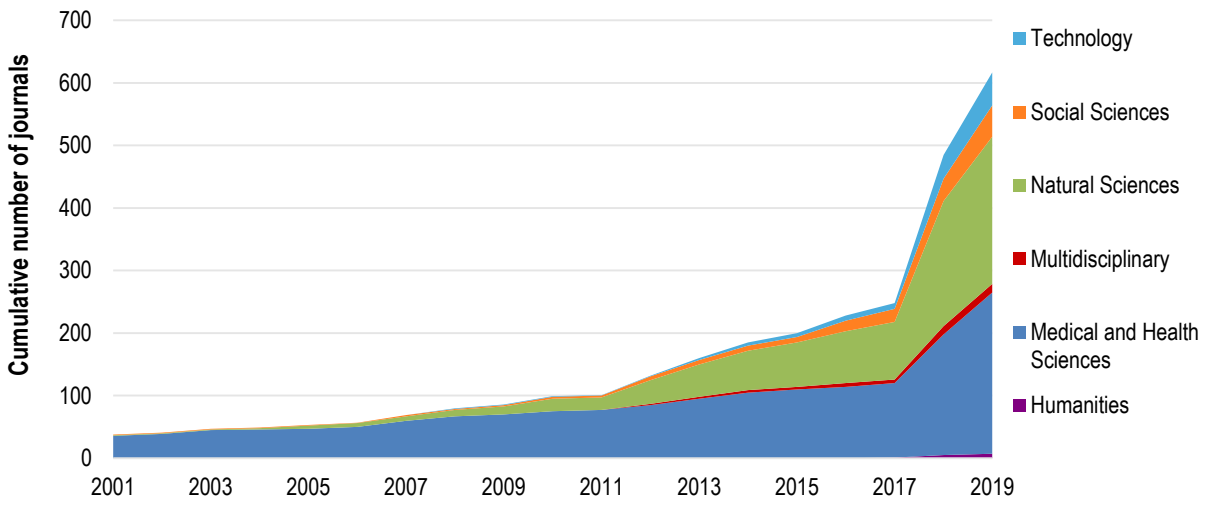
Open peer review journals represent one way in which digitalisation is making science more open and accountable. Open access to academic papers and other forms of scientific communication (e.g. blogs)

allows for ideas to circulate faster and at a low cost. In addition, open access to research data facilitates the reproducibility of studies, the verification of their results and the re-utilisation of data for further research and educational purposes.

Furthermore, digital technologies allow a variety of social actors (citizens, civil society groups, industries and policy makers) to engage in scientific activities, from agenda-setting and co-production of research to the dissemination of scientific information and, of course, science learning.

Figure 3.6. Full disclosure: The rise of open peer review

Cumulative number of open peer review journals by discipline groups, 2001-2019



Source: Wolfram et al. (2020), "Open peer review: Promoting transparency in open science", https://doi.org/10.1007/s11192-020-03488-4.

StatLink https://stat.link/g9joxy

And education?

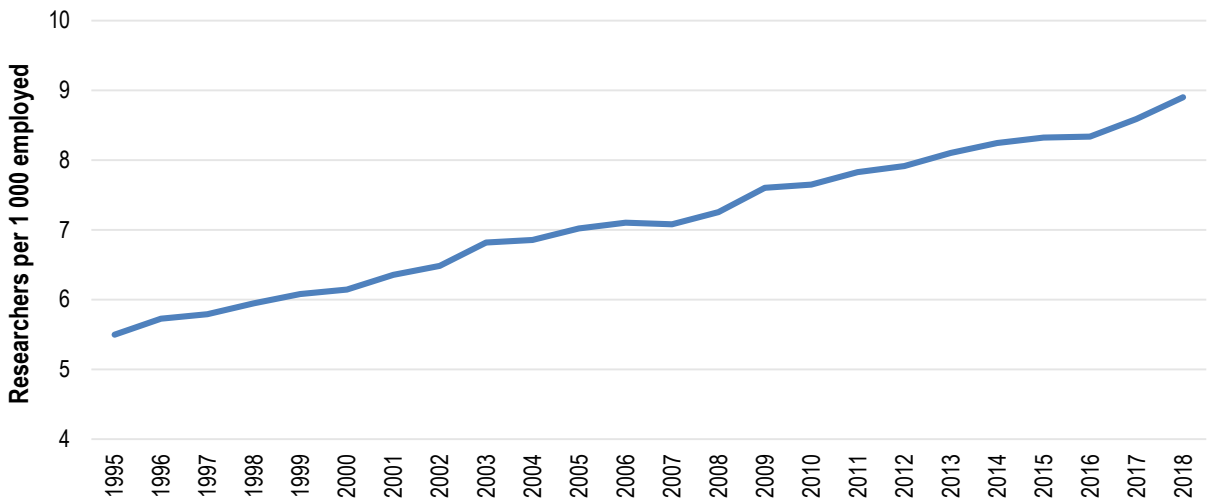
- Can direct engagement with academic research strengthen learners' scientific knowledge and identities? Could citizen science be used for role modelling, encouraging greater female engagement in STEM? Is scientific literacy a basic democratic need?
- Open access, big data and AI are transforming the ways science is produced and used. What digital skills are required for data-intensive science? What changes are needed in education and training?
- Educational institutions generate more and more data on their students. Should all these data be shared more openly with different stakeholders (e.g. students, parents, media)? What impacts would this have for student-teacher, teacher-parent and other relationships? For example, what are the pros and cons of parents' ability to monitor closely their children's daily school life?

Knowledge governance

Addressing complex challenges such as the climate crisis and global economic governance requires political will and compromise based on precise analysis and understanding. In other words, it requires reliable knowledge. Across the OECD, research and development (R&D) activities are increasing as part of the quest for greater knowledge and innovation. For instance, the number of researchers has steadily risen over the last three decades. Meanwhile, governments continue to spend large sums of money for research and innovation in public and private sectors. An emerging concern is how to leverage such investment to build resilient and sustainable economies and societies. Promoting relevant educational research and scaling up effective innovative practices is also key for enhancing education's quality.

Figure 3.7. In need of expert knowledge

Number of researchers per 1 000 employed, OECD average, 1995-2018



Note: See OECD (2021), *Main Science and Technology Indicators* (database) https://stats.oecd.org/, for details about the distribution of researchers across different sectors.
Source: OECD (2021), *Main Science and Technology Indicators* (database), https://stats.oecd.org/.

StatLink https://stat.link/yvx19j

Some have claimed that knowledge is the new gold. The number of individuals working in research activities has risen steadily over the last three decades. In 2018, an average of 9 out of 1 000 full-time employees across the OECD was dedicated to the creation of new knowledge, up from less than 6/1 000 in 1995.

Business enterprise employees accounted for over 60% of this research workforce across the OECD in 2018, compared to less than 10% working for government institutions (a share that has been declining in recent years). Researchers in academia are also an important part of the research workforce, although their share varies across countries. For example, in 2018, they represented over 50% of all researchers in the United Kingdom, about 40% in Mexico, over 30% in the European Union and Turkey, and 10% in Korea.

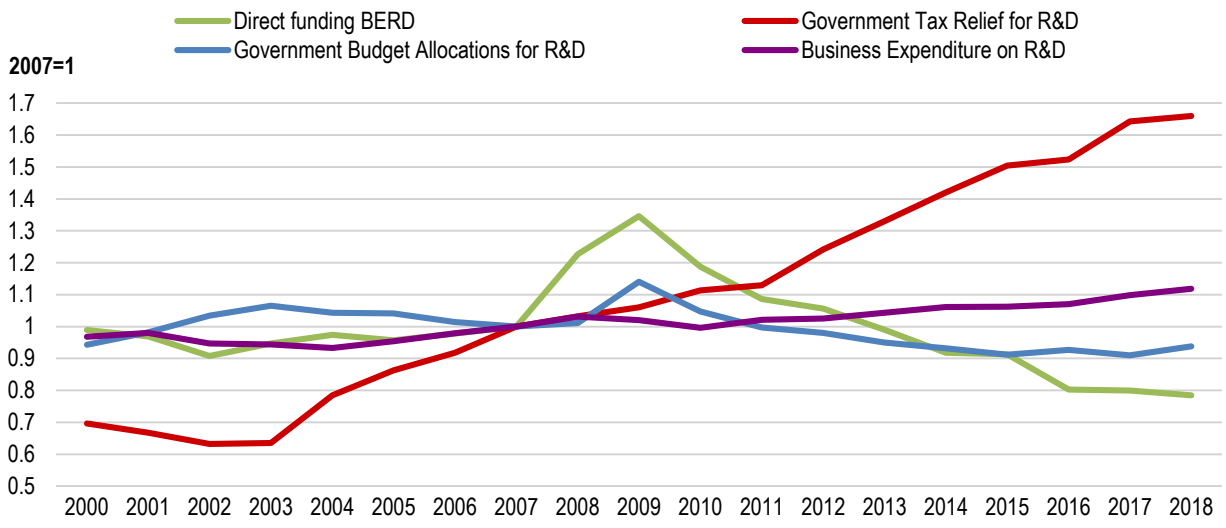
In decentralised market economies, businesses are key actors in research and innovation. At the same time, public funding has had and continues to play a key role in shaping the extent, nature and direction of innovation. In recent years, governments have changed the ways they support business enterprise expenditure on R&D (BERD), relying increasingly on indirect support measures like tax incentives, rather

than direct support tools, such as R&D grants. Across OECD countries, tax incentives represented around 56% of total government support of business R&D in 2018, compared to 36% in 2006.

Drivers of this shift include international trade and competition rules, and the generalised perception that firms, not governments, make better decisions on which projects to invest in. But these trends might be changing: in recent years, there has been a push for governments to strategically guide private innovation efforts to where they are most needed, encouraging risk-taking R&D that private actors are not always willing to take on.

Figure 3.8. Government support for innovation

Government R&D funding policy mix, OECD countries, 2000-2018



Note: This chart displays figures for 37 OECD countries (see the original source for greater detail).
Source: OECD (2021), *OECD Science, Technology and Innovation Outlook 2021: Times of Crisis and Opportunity*, https://doi.org/10.1787/75f79015-en.

StatLink https://stat.link/hywnkp

And education?

- How can we promote the production of educational research that is relevant for policy and practice? How can we promote its use? What is the role for knowledge "brokers", who work to ensure the quality of the evidence and translate research for policy makers and practitioners?
- How do different actors (e.g. private or public), institutional incentives (e.g. "publish or perish") and relationships (e.g. hierarchies, networks, trust) shape the quality of academic research? How can we best support the production of high-quality education research?
- Wisdom acquired through experience is crucial to good teaching. To what extent do knowledge management tools like school evaluation and teacher appraisal consider and leverage such tacit knowledge and expertise?

Speaking truth to power

Sound political decisions rely on good information. However, experts do not always agree, especially when addressing complex, rapidly changing phenomena where robust evidence is not yet available. Here, democracy plays with a trump card: tolerance and articulation of dissent allow it to grasp collective intelligence and learn. Democracies are, like science, self-correcting; the actions of those in power – and the knowledge on which they rely – are open to debate and public scrutiny. The rise of freedom of information laws and citizen deliberative processes are becoming key to the exercise of democratic citizenship. They help maintain government transparency and fairness; safeguard the right of citizens to contest decisions that may appear unsubstantiated or serving particularistic interests; and improve policy outcomes along the way. What do these trends mean for education?

Figure 3.9. A public's right to know

Rate of adoption of right to information laws, OECD countries, 1766-2019

Note: Each tally represents a country and its package of right to information laws. For example, Sweden first passed laws in 1766 and counts as one. In 1951, Finland followed and raised the number to two.
Source: RTI Rating (2019), *Historical Data on Country RTI Rating Scores, 2019*, https://www.rti-rating.org/.

StatLink https://stat.link/p4sfk7

Citizenship is not only something stated in a passport. Citizenship is also actively exercised, founded on civil rights and liberties such as freedom of speech and the right to vote. In a knowledge society, the 'right to know' emerges as a key additional pillar. Freedom of information laws – laws granting access to information held by public bodies – are not new. Sweden's Freedom of the Press Act dates back to 1766.

Yet it was not until 1946 that the United Nations recognised freedom of information as an integral part of the fundamental right of freedom of expression. Two years later, it became part of the Universal Declaration of Human Rights. Even though freedom of information laws vary in depth and breadth internationally, the number of OECD countries recognising a 'right to know' grew from one country in 1950, Sweden, to 37 in 2019.

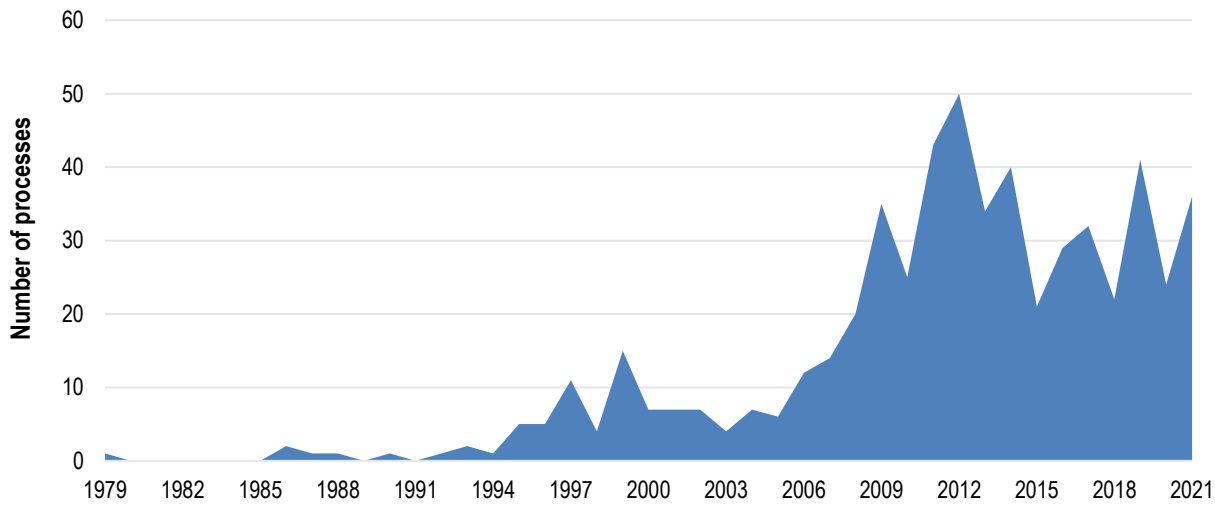
More recently, citizens have been increasingly called upon to participate directly in the policy process, examining existing evidence to discuss and agree on potential solutions. This is the case of representative deliberative processes, such as Citizens' Assemblies, Juries and Panels, which allow small, broadly representative groups of randomly selected citizens to produce informed policy recommendations for

public authorities. Increasingly common over the last four decades, representative deliberative processes help mobilise knowledge and build consensus and legitimacy, particularly around issues that are values-based, require trade-offs and demand long-term solutions. Furthermore, they strengthen citizens' political efficacy and civic engagement.

Recent examples of representative deliberative processes include the French Citizens' Convention on Climate (2019-2020), or the Irish Citizens' Assembly, which aimed to address socially divisive issues such as abortion and gender equality (2016-2018 and 2020). Education can help cultivate the essential knowledge, critical thinking and communication skills and attitudes necessary to participate in deliberative politics and society.

Figure 3.10. A wave of deliberative politics

Number of representative deliberative processes over time, OECD countries, 1979-2021



Note: The figure includes data for OECD member countries plus the European Union. Processes that spanned over multiple years are noted by the year of their completion (except for permanent ongoing processes).
Source: OECD (2021), *OECD Database of Representative Deliberative Processes and Institutions* (database), https://airtable.com/.

StatLink https://stat.link/yjm2vo

And education?

- Does more knowledge lead to more action – and if so, what kind? How should education systems confront difficult questions about combining knowledge with values? Competing interests? Should civil disobedience be taught (not necessarily promoted) in civics?
- Does a classroom culture that promotes respectful dissent and debate support better learning? If so, are learners given the time and space to form and articulate their own opinions? In your education institution, is it okay for students and teachers/professors to be wrong, to make mistakes?
- What is the potential of policy co-creation (such as in representative deliberative processes) in education? By including underrepresented voices, could it increase evidence quality, inclusivity and public trust?

What future for knowledge, power and education?

Trends allow us to consider what current patterns might mean for the future. But what about new patterns, shocks and surprises that could emerge over the next 15 to 20 years?

Building on the OECD Scenarios for the Future of Schooling, this section encourages readers to consider how growth could connect with education to evolve in multiple ways. Two vignettes illustrate possible stories: the Reader is invited to adapt and create new ones as desired. The next page sets out some key questions for education, and a set of potential shocks and surprises that could impact education and learning in unexpected ways. The descriptions of each scenario can be found in the Introduction of this volume.

Scenario 1 Scenario 2 Scenario 3 Scenario 4

At first, nobody took it seriously. Now, it's a mediatic storm. "#DitchSchool" has accumulated millions of mentions on PikPok and Instamash in just two days. "Frankly, after years of introducing cameras, wereables and other surveillance tools in our classrooms, it's shocking that this is a surprise to anyone" comments Quynh, a professor of sociology, in an interview. Tracking students has been a major policy focus, and District authorities have prioritised real-time data on student social and emotional states to improve learning and teaching. "The truth is that both local research and international surveys show increasing levels of student disaffection towards school" Quynh continues. She concludes: "Of course attendance and engagement matter, but by now it seems pretty clear that the cure has become worse than the disease."

Eri looks at herself in the mirror and takes a deep breath. This is her first day in her new role on the Supreme Council, and everything has to be just right. The Council is charged with ensuring intergenerational accountability and Eri's speciality is auditing algorithms for bias. Already there are clear demonstrations of seemingly harmless choices made by schools in the 2020s that inadvertently decreased opportunities for the most disadvantaged: "smart" platforms (but not so smart in the end), limited interoperability, biased pedagogy...
"No wonder schools are extinct!" she thinks. "I am 14 years old and I am definitely not prepared to keep paying for the mistakes of the past!" She straightens her back. She is not just thinking of herself: she has a responsibility to future generations as well.

In 2040, things look quite different

Qualification, socialisation, care and credentialing arrangements may differ across alternative futures.

By 2040, how could the goals and functions of education be impacted by developments such as:

- open knowledge?
- big data and artificial intelligence?
- changing democracy and public institutions?

What is expected from education?

Changing values, science and technology shape learning. In 2040…

- are formal/informal learning still different?
- how much power do learners have over their own learning?
- to what extent have AI systems permeated education? How and for which purposes?

How are space, content, time and relationships organised?

Who educates and in which conditions?

By 2040…

- are teaching activities and profiles more or less diverse?
- is teaching based on professional standards or is it more open access?
- do educational settings, such as nurseries, schools and universities, still exist in a physical format?

Who is responsible for what and accountable to whom?

Views on education differ across stakeholders, and so does their capacity to influence decisions. In 2040…

- what are the roles of government, market and civil society?
- is decision making transparent? Is it inclusive?
- in which ways does the geopolitical context affect the provision of education and learning?

Shocks and surprises

Despite the best laid plans, the future likes to surprise us. What would these shocks mean for education and learning if they came to pass? Can you see signs of other potential disruptions emerging?

Stateless digital citizenship

With digital identities and related technology (e.g. digital payments), peer-to-peer communities provide services traditionally provided by states

Deepfakes

The capacity to convincingly manipulate audio-visual content has become widespread and entirely fictional videos, narratives and images are commonplace

We the People?

AI and other non-human intelligences are now considered citizens and can vote/make choices about the public good

Digital wars

Cyber-attacks and assaults on the digital infrastructure (e.g. internet undersea cables) launched by countries or non-state actors threatens security, health and democracies themselves

Find out more

Relevant sources

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Glossary

- **Algorithm**: A set of calculation or operation instructions for specific tasks, especially for computers. These can be simple processes, such as multiplying two numbers, or complex ones, such as playing a compressed video file. For example, search engines use algorithms to display the results from their search index for specific queries in a particular order, using criteria like relevance.
- **Artificial intelligence** (**AI**) **system**: A machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments.
- **Citizenship**: One's formal legal and political status and a sense of belonging. It entails the right and responsibility to make rights claims regarding issues that affect one's well-being.
- **Data**: Collection of facts, observations.
- **Data fishing**: The misuse of data by performing many statistical tests and only reporting those that present significant results.
- **Datafication**: The rendering of social and natural worlds in machine-readable digital format.
- **Democracy**: Political system in which citizens are allowed to participate in decision making and discussions. Politicians are typically elected by the citizens in free and fair elections, and serve therefore as representatives of the people.
- **Digital literacy**: Having the competences needed to live and work in a society where communication and access to information increasingly take place through digital technologies such as the internet and smartphones.
- **Digitalisation**: The use of digital technologies and data as well as their interconnection, which results in new activities or changes to existing ones.
- **Freedom of information laws**: Laws aimed at allowing citizens to have access to information and data held by public entities in order to guarantee maximum transparency and accountability of government operations, encourage the reuse of information, and generate social and economic value.
- **Information**: A collection of data that is meaningful. Information has added context to data and it can be shared (e.g. through writing or teaching).
- **Knowledge**: Information that has been retained with an understanding about the significance of that information. Knowledge includes information gained by experience, study, familiarity, association, awareness and/or comprehension.
- **Market economy**: An economic system in which goods and services are made, sold, and shared and prices set by the balance of supply and demand.
- **Open peer review journals**: Academic journals that disclose the identities of their articles' reviewers and/or the review reports of the articles.
- **Partial publication**: Not publishing or only partially publishing the complete datasets or research material needed to validate research through a replication study.
- **Research and development (R&D)**: Research and creative work conducted by either the private and/or the public sector to develop new goods, techniques and services, and to increase the stock of knowledge and the use of this knowledge to devise new applications.
- **R&D grants**: Financial support, typically awarded by governments, to a person or company in order to fund research and development activities.
- **Representative deliberative processes**: A randomly selected group of people who are broadly representative of a community spending significant time learning and collaborating through facilitated deliberation to form collective recommendations for policy maker.
- **Researchers**: Professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, as well as in the management of the projects concerned.

- **Retracted scientific publications**: Articles that are withdrawn from the journal in which they appeared after original publication. Retractions are issued through a decision made by the publication's editorial board.
- **Tax incentives**: A governmental measure that is intended to encourage individuals and businesses to spend money or to save money by reducing the amount of tax that they have to pay.
- **Universal Declaration of Human Rights**: A document adopted by the United Nations General Assembly affirming an individual's rights, such as the right to life and freedom from slavery.
- **Wikipedia**: A free, multilingual online encyclopaedia written and maintained by a community of volunteer contributors through a model of open collaboration.

4 Identity and belonging

In a global and digital world, the binding power of old institutions is declining while new identities and ways of belonging are emerging. Education can help support the needs of diverse learners and their communities while cultivating global competences. This chapter explores these issues through five themes:

- **You can go your own way:** examines the decline of traditional institutions and rise of individualism.
- **It's a small world after all:** looks at diversification within nations and multilateral cooperation.
- **Speak your mind:** highlights changing patterns of civic and political engagement.
- **All for one and one for all:** shows how LGBTI+ and disability rights and opportunities are evolving.
- **The many profiles of us:** examines the role of digital platforms in identity and community formation.

These trends are linked to education and its future through a series of questions and scenarios. Potential implications of COVID-19, both immediate- and longer-term, are discussed.

Overview and impact of COVID-19

Understanding who we are and where we belong is a fundamental aspect of human development. In a global and digital world, individualisation and choice increasingly defines our lives, and communities are diversifying. Traditional binding powers like religion and nationhood are declining in many countries. Yet at the same time, new ways of collaboration and belonging are emerging. Some previously marginalised groups are finding their voice and communities. New political movements and the expansion of multilateral cooperation bring people – and nations – together based on shared values and causes. And the virtual world facilitates the exploration and expression of personal and group identities in an entirely new way. Yet these developments bring their own dilemmas and risks. In education, key challenges include meeting the needs of diverse learners and creating local senses of belonging and citizenship, while simultaneously cultivating global competences for the 21st century.

Identity and belonging & COVID-19

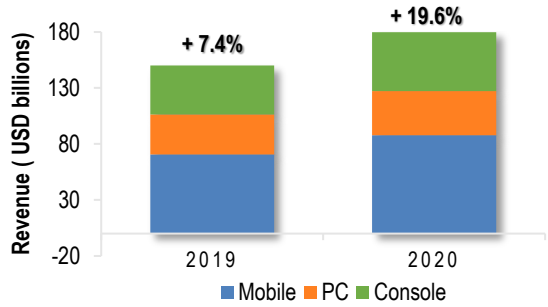
The COVID-19 pandemic is a reminder that, despite our best laid plans, the future likes to surprise us. Trends can accelerate, bend and break. As the shock subsides, open and important questions emerge about the long-term effects of these shifts.

ACCELERATE

Will we continue to socialise more and more virtually?

Video game sales exploded during COVID-19, as digital platforms and mobile games grew to meet the demand. Many first-time players joined as a way to find social outlets and entertainment during lockdowns.

Increase in global video game sales, 2019-2020



International Data Corporation (IDC) cited in Witkowski (2021), https://www.marketwatch.com

BEND

What about the children?

COVID-19 has exacerbated existing deprivations, like poverty and family stress, with a 'hidden pandemic' of new orphans and children without essential care. What will be the long-term impact on their well-being and life outcomes?

From March 1, 2020, to April 30, 2021:

over **1 million children** globally experienced the death of primary caregivers, including at least one parent or custodial grandparent

over **1.5 million**—an additional 400 000--experienced the death of at least one primary or secondary caregiver.

OECD (2020), https://doi.org/10.1787/2e1f3b2f-en; Hillis et al. (2021), https://doi.org/10.1016/S0140-6736(21)01253-8.

BREAK

What future for the arts?

The arts offer beauty, entertainment and places to come together. Cultural industries are key to the economy as employers and sponsors of the arts. They also provide ways to examine ourselves and the world around us, to discuss and reflect together, and to learn.

Pre-pandemic, the number of museums was growing worldwide…

1975	2012	2020
22 000	59 375	104 000

84% of museums temporarily closed during the pandemic and **10%** might never reopen due to economic hardship.

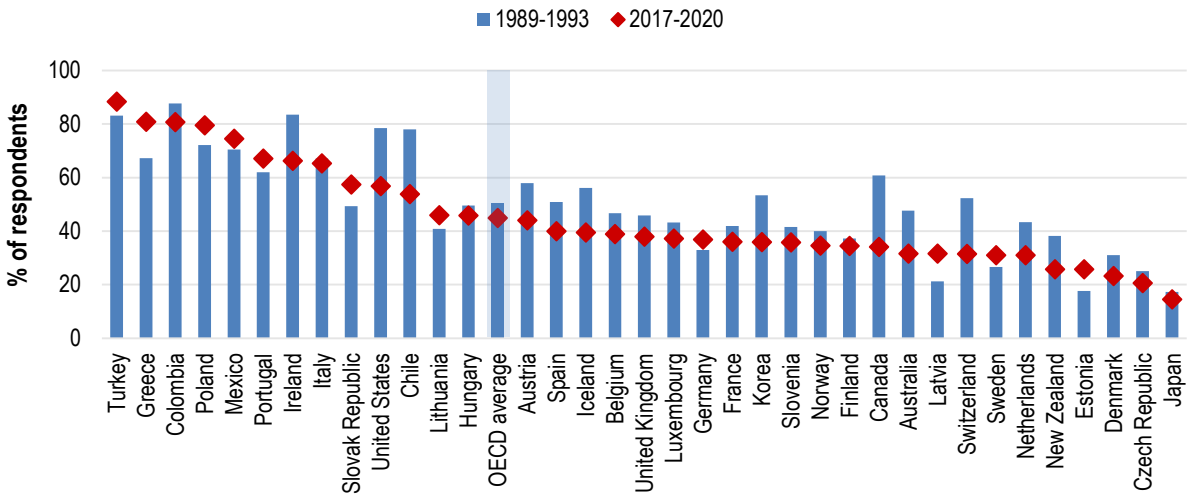
UNESCO (2021), https://unesdoc.unesco.org/.

You can go your own way

From ancient rituals to medieval guilds, institutions and practices based on tradition have long helped to transmit knowledge and establish community. They help ground identity and shared values and norms. In recent decades, many major social institutions have declined and so has their binding power. Religion is, on average, less important to people now than a generation ago. Trade union density is just a fraction of what it was 50 years ago. Today, customary practices, beliefs and affiliations are more open to debate and choice. What does that mean for identity and belonging? What does it mean for equity? Education can help socialise individuals into common norms and values while supporting the positive identities and agency needed to pursue learning and well-being.

Figure 4.1. Are you a believer?

Individuals who identify religion as "very important" or "rather important" in their life, early 1990s and late 2020s



Note: OECD average includes 36 countries. Where the data for countries were not consistently available in the same years, figures from the closest years are used (see StatLink for full information).
Source: OECD calculations based on the World Values Survey and European Values Survey.

StatLink https://stat.link/hk2qmy

Traditionally central to society, religion is becoming less essential for many OECD citizens. Since the early 1990s, the number of individuals who identify religion as important in their life has declined 6% on average across the OECD. This average masks large differences. Religiosity grew 14% in Greece and 8-11% in Estonia, Latvia, Poland and the Slovak Republic, but these gains pale compared to decreases of 18% or more in Chile, Ireland, Switzerland and the United States. The biggest decline over the time period, 27%, was seen in Canada.

However, a huge range of religiosity exists across countries: in Turkey and Colombia, 80% or more continue to identify religion as important, compared to 14% in Japan. These cultural shifts come largely from increased mobility of people and ideas, the spread of information and communication technologies, and rises in individualistic values. Inherited social practices and beliefs are nowadays more open to debate, interpretation and personal choice.

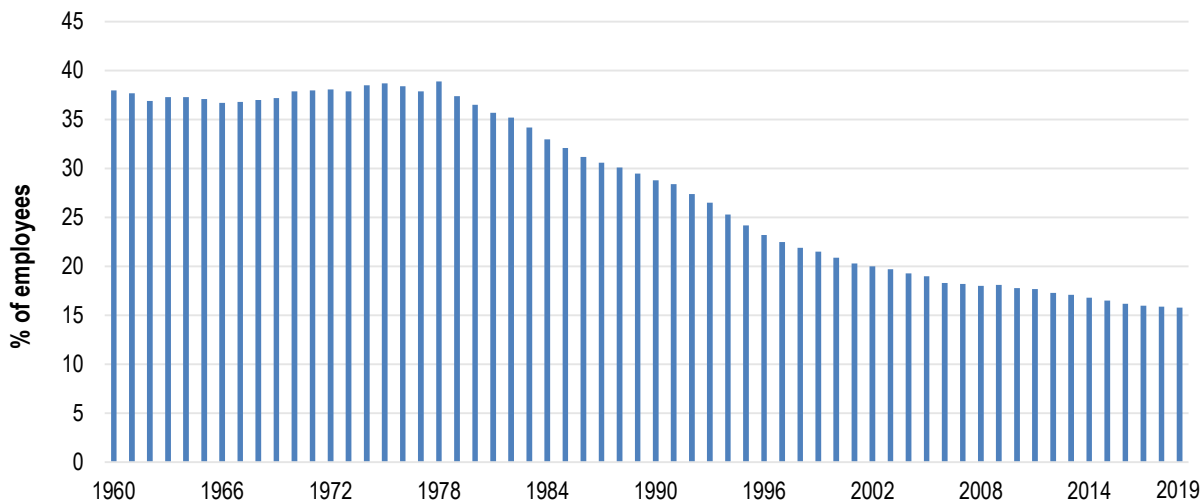
Social and other institutions are also weakening in other areas. For example, trade union density within the OECD decreased from 39% to 16% between 1978-2019. The overall decline, however, obscures substantial differences. In 2019, union density ranged from almost 91% in Iceland to 6% in Estonia.

Nordic countries have maintained trade union densities of 60% or more, while other countries, such as Chile, Germany, Japan, Turkey and the United States, always had lower density levels and now lies at 17% or less.

In post-industrial societies, identity is less fixed to professional affiliations like unions or employers or even to particular professions. Individual freedom and choice are increasingly central paradigms, and the identities learners build influence how they relate to themselves and others, affecting their learning, well-being and future aspirations. Education institutions and professionals have a role in supporting learners grow into healthy, responsible and caring persons and peers.

Figure 4.2. A worker's right to choose

Trade union density, OECD countries, 1960-2019



Note: These data are based on estimated values. For further detail about the calculations in this graph, see the original source below.
Source: OECD (2021), "Trade Unions: Trade union density", *OECD Employment and Labour Market Statistics* (database), https://doi.org/10.1787/data-00371-en.

StatLink https://stat.link/7honfr

And education?

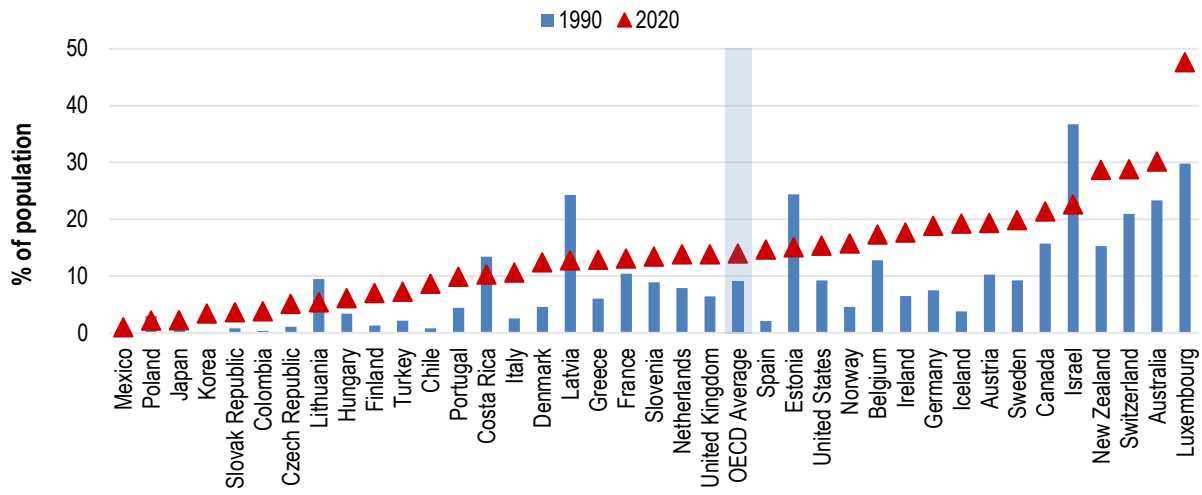
- Student identities and background (e.g. ESCS, gender) influence academic achievement and aspirations. How can education institutions encourage positive and ambitious learning identities while still accepting students as they are and helping them feel comfortable with themselves?
- Education institutions are unique social institutions that play a role in both encouraging shared identities and supporting students in realising their own best/learning selves. How can education institutions encourage positive, shared values while also supporting learners' individual needs and development?
- Are teachers losing their traditional authority? How might we reimagine student-teacher relationships and discipline systems in schools?

It's a small world after all

For several centuries, nation states have organised communities beyond the tribe and the family, fostering mutual trust through a shared sense of belonging. More recently, the twin acceleration of globalising and localising forces has strained the binding power of these 'imagined communities'. Within states, steady migration flows have diversified populations and societies, bringing greater cultural diversity and economic opportunities. Beyond states, multilateral organisations have proliferated, reflecting steady growth in international collaboration as governments confront increasingly complex and global issues, from inequality to climate change. Supplying appropriate resources and support for students of different backgrounds will continue to be a priority for education systems. Education has a role to play in equipping students with the competences needed for a diverse and global future.

Figure 4.3. Home, new home

International migrant stock by country of destination, OECD countries, 1990-2020



Note: Mid-year data used. All data refer to foreign-born populations, except: Czech Republic, Japan and Korea are based on number of foreign citizens; Costa Rica, Israel, Korea, Mexico and Turkey also include estimates for refugees and asylum-seekers. See StatLink for details.
Source: UNDESA (2020), *International Migrant Stock 2020*, https://www.un.org/.

StatLink https://stat.link/qhte0b

From local to national to supranational levels, political and cultural communities are diversifying and transnational connections growing. Diasporas contribute to foreign investment, trade and innovation as well as cultural exchange.

Since 1990, the international migrant stock in OECD countries has increased from 9% to almost 14% of the total population. Globally, some 281 million people lived outside their country of origin in early 2020. Within the OECD, permanent migration stems mostly from labour migration, increased mobility within free movement areas (e.g. the European Union) and family reunification.

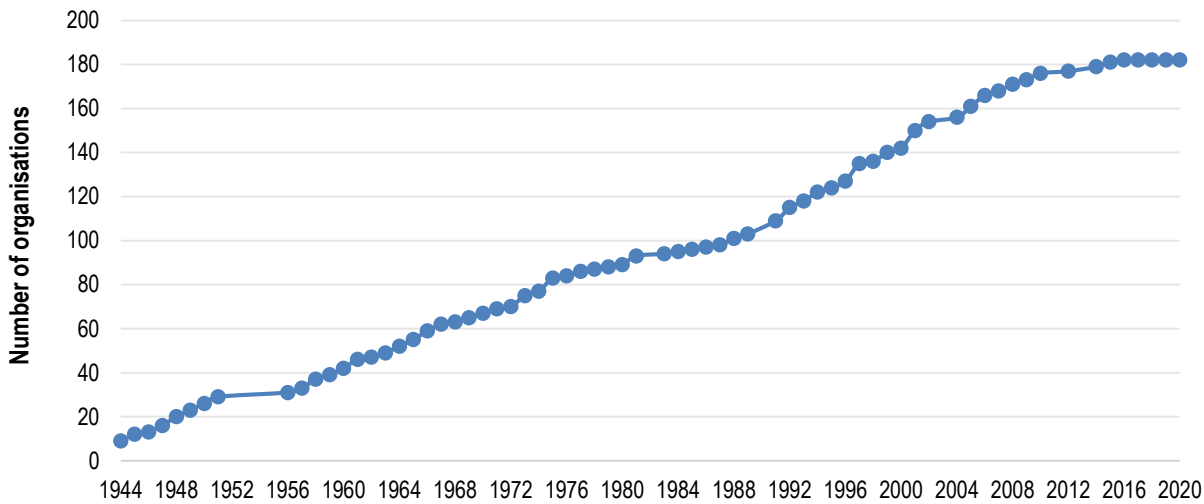
Despite high-profile influxes in countries like Turkey, permanent humanitarian migrants, such as those granted asylum, only comprised 11% of total permanent migration in 2019. These averages, however, mask notable differences between countries. While the foreign-born population across this period grew by 17% in Luxembourg and 15% in Iceland, they decreased in the Baltic states and Israel and barely changed in Japan, Mexico and Poland.

Meanwhile, transnational networks are expanding. Since 1944, the number of multilateral development organisations has grown from 9 to over 182. This expansion has seen multiple phases, from the original post-war reconstruction banks to the creation of regional development banks in the 1960s and 70s. Starting in the 1990s, sector-specific 'vertical funds' arose, such as the Global Environmental Facility and the Vaccine Alliance.

Along with this, an international civil society is also growing. For example, since its first campaign in Portugal in 1961, by 2020 Amnesty International had expanded operations to 149 countries. The World Wildlife Fund has similarly expanded from one campaign in Switzerland, the United Kingdom and the United States to projects in 100 countries. Taken together, these trends reflect more collaboration, but some fear it also signals more fragmentation that will limit our ability to address global challenges like climate change. Education can support learners to develop strong global competences, helping citizens to bond across cultural and social differences and contribute to solving our shared, global challenges.

Figure 4.4. We're all in this together

Cumulative number of multilateral development organisations, 1944-2020



Note: Data represent number of multilateral development organisations receiving funding per OECD's Credit Reporting System (CRS).
Source: OECD (2020), *Multilateral Development Finance 2020*, https://doi.org/10.1787/e61fdf00-en.

StatLink https://stat.link/a791ob

And education?

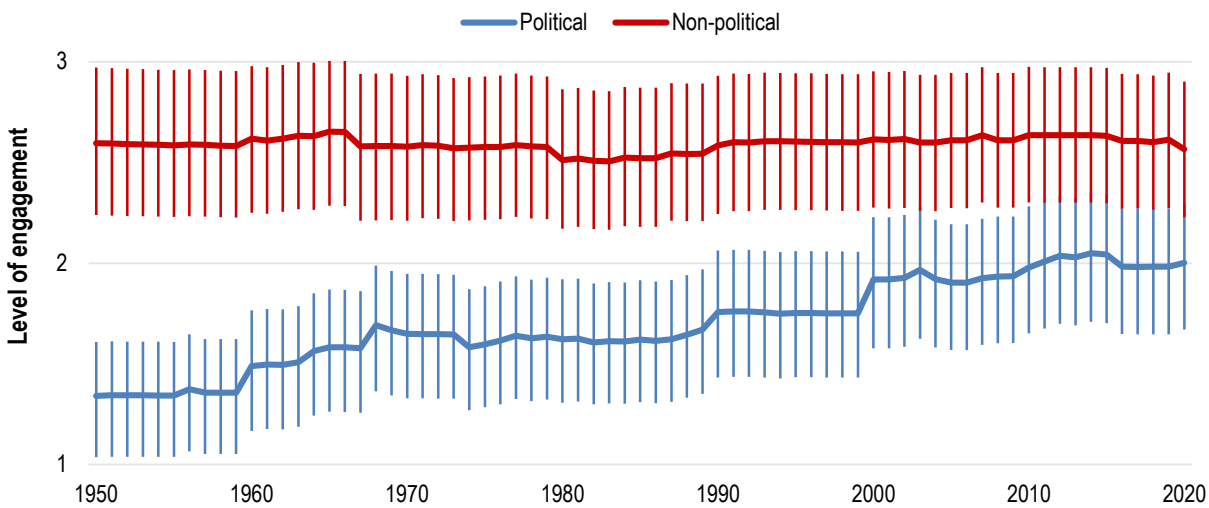
- As social diversity rises, connecting to others through open and appropriate multi-cultural interactions is increasingly relevant. How can education foster understanding, tolerance and appreciation of different cultural perspectives and world views within society?
- Nowadays, migration is increasingly temporary or circular rather than permanent. What does this mean for teaching citizenship and identity? And for education planning and delivery?
- School systems are traditionally based on national models and identities. As schooling becomes increasingly digitalised, could an international school system emerge? Alternatively, can you imagine learners enrolling in a public school system of a country different than their own?

Speak your mind

Citizenship is a legal status, but also a place of belonging where individuals become agents of their own well-being. In recent decades, traditional measures of civic participation, such as voter turnout, have fallen in many countries, raising concerns about citizens' apathy and disaffection. But is that actually the case? Today, citizens seem to understand and experience politics in novel ways: more personally, more informally and outside the domain of conventional institutions and geographical boundaries. At the same time, demands to include more voices in the public debate, such as those of younger citizens, are growing. Education has the role of channelling society's expectations about the kind of citizens children ought to become. What citizenship entails, and which educational practices contribute to realising it, remain core issues defining the ends and means of education.

Figure 4.5. Get up, stand up

Engagement in political and non-political independent associations, OECD countries, 1950-2020



Note: This chart shows the share of the population who attend a meeting, activity or event of independent associations at least twice a year. Responses are scaled ranging from 0 (virtually no one) to 4 (a quarter of the population or more), based on the scores of multiple experts. The vertical lines represent confidence intervals for estimated values. See further details in the StatLink.
Source: Coppedge et al. (2021), "V-Dem Dataset v11.1", Varieties of Democracy Project, https://doi.org/10.23696/vdemds21.

StatLink https://stat.link/zhbvwo

Indicators of political participation, such as voter turnout, have fallen across many OECD countries in recent decades, suggesting a growing disengagement of citizens towards their shared political institutions. At the same time, citizens' engagement with political independent associations – those seeking to influence the direction of political matters, such as environmental protection or LGBTQI+ rights groups – has risen over the last 70 years, approaching the levels of engagement with non-political associations such as sport clubs or literary societies.

Diverse new forms of citizen engagement are emerging beyond traditional, government-focused action organised around players like unions and parties. Increasingly, citizens express their voices in more individualised and personalised ways (e.g. politically conscious acts of consumerism), occurring informally – often digitally and globally – within more flexible and loose networks, outside the institutional arena.

Beyond engagement, democracies face questions about whose voices are heard and whether others should be counted. Youth voices are one important example: on average across the OECD, voting age

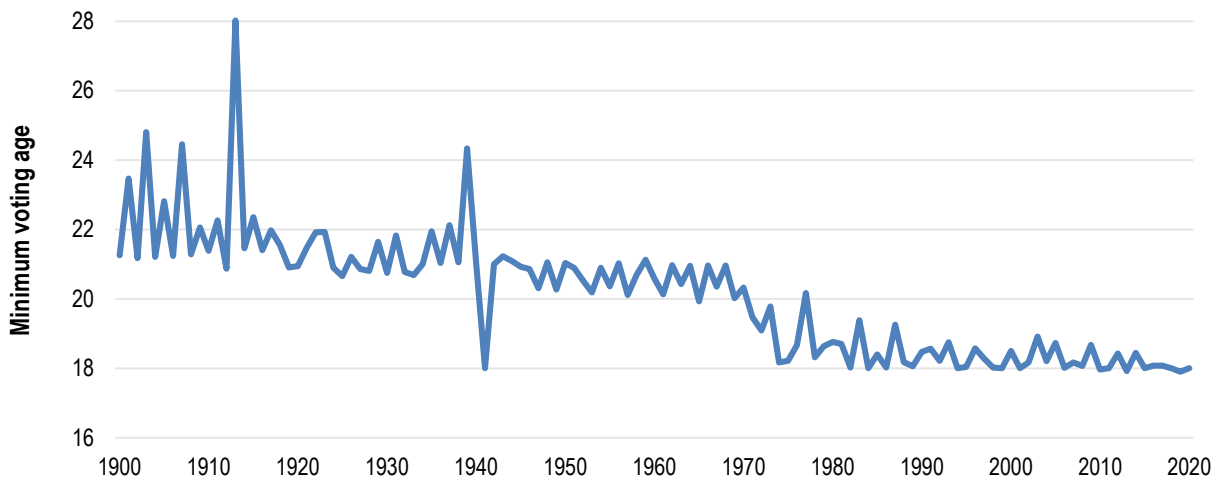
steadily declined throughout the last century. In 2010, the average minimum voting age fell below the threshold of 18 years for the first time. In 2007, Austria became the first OECD country granting its 16- and 17-year-olds the right to vote in national elections.

Debates about voting age are just the tip of the iceberg of a wider democratic issue: current generations are making decisions with long-lasting impacts. How can voiceless and dependent agents, such as future generations, fauna and flora, factor into our decision making?

This is not an academic argument: opportunities for individuals to voice their opinions and engage actively in their communities through education are predictors of civic engagement. Furthermore, education plays a key role in raising responsible citizens: citizens that realise their actions come with consequences, and that act empathetically in accordance.

Figure 4.6. From the schoolyard to the ballot box

Average minimum voting age across OECD countries, 1900-2020



Note: This chart displays a population weighted OECD average.
Source: Coppedge et al. (2021), "V-Dem Dataset v11.1", Varieties of Democracy Project, https://doi.org/10.23696/vdemds21.

StatLink https://stat.link/xqeo32

And education?

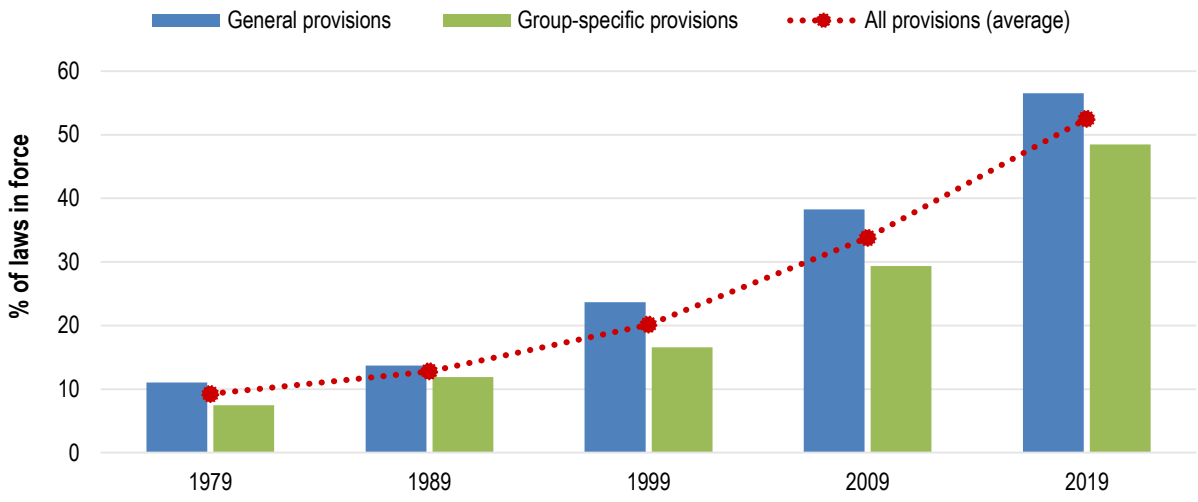
- In more fragmented societies, the capacity of leaders to bridge gaps and generate broad coalitions is as increasingly difficult as it is necessary. Do citizens value such ability in their representatives enough? Should education help them do so? If yes, how? What competences are needed?
- How can educational organisation and teaching practices promote bonding and group cohesion? What about student voice and engagement? In your system, are these important in assessing education's quality?
- Knowledge and skills positively correlate with individuals' level of political self-efficacy, trust in institutions and in other citizens, and likelihood of voting. How high does developing learners' "taste for learning" and their abilities for "learning to learn" rank among your system's priorities?

All for one and one for all

Human rights are universal and inalienable. However, many individuals face discrimination based on who they are or are perceived to be. Harmful social views and prejudices towards race, background, gender, disability, or sexual orientation still prevent many from participating fully in all aspects of life. Over the past few decades, governments have increased their efforts to fight discrimination and advocate for and protect universal human rights. Two examples of the shift to more inclusive societies are the growth of legal provisions protecting the rights of lesbian, gay, bisexual, transgender, queer and intersex (LGBTQI+) people and the Paralympic movement. In education, identifying and responding to the variety of individual circumstances and social contexts that give birth to discrimination and disadvantage is a key first step to ensuring accessible, acceptable, adaptable and affordable education for all.

Figure 4.7. Pride and prejudice

Evolution of legal LGBTI inclusivity in OECD countries, 1979-2019



Note: Legal LGBTI inclusivity is defined as the number of laws in force in a given country (as of 2019) among a basic set of LGBTI-related laws defined within the framework of international human rights standards. See StatLink for more detail.
Source: OECD (2020), *Over the rainbow? The road to LGBTI inclusion*, https://doi.org/10.1787/8d2fd1a8-en.

StatLink https://stat.link/okhqbu

Sexual orientation, gender expression, or sex characteristics that do not conform to traditional views are often misunderstood, unappreciated or taboo. LGBTQI+ people can suffer from discrimination, marginalisation and victimisation in the family, community and workplace. This can affect mental and physical health, educational and labour force outcomes as well as later life success.

To address this, many countries have taken legal steps to safeguard the rights of LGBTQI+ people. These include general provisions to prevent discrimination and violence, and group-specific ones, such as legalising same-sex partnerships or declassifying transgender identity as a disease.

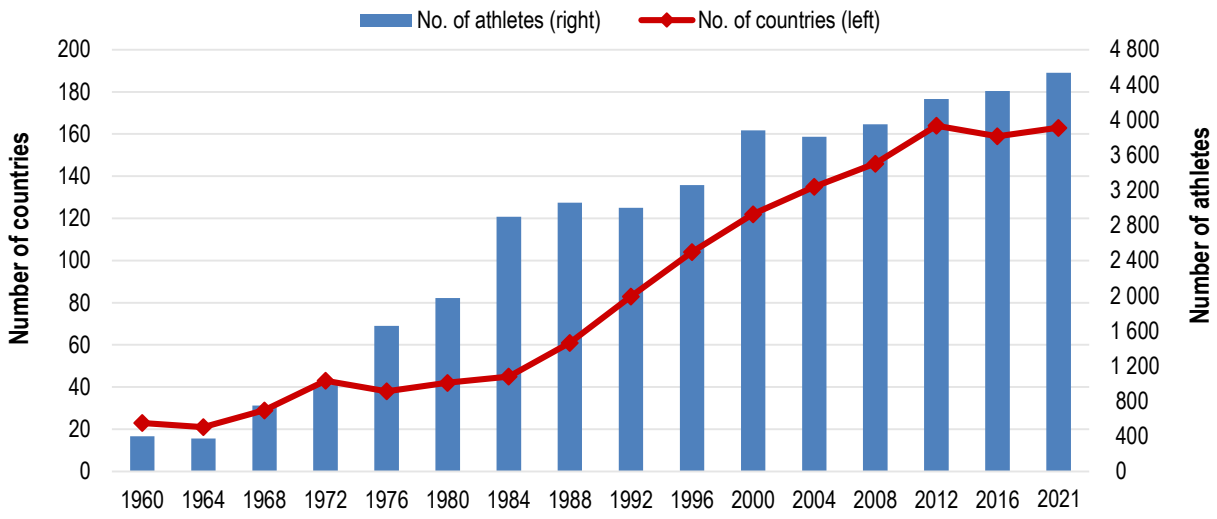
In the late 1970s, less than 10% of such measures were enacted across OECD countries. This had risen to over 50% by 2019, with Canada, France, the Netherlands and Portugal providing the highest rates of inclusive legal action on average. General anti-discrimination provisions are most common across the OECD, followed by provisions that are specific to lesbian, gay and bisexual groups. Fewer provisions specific to transgender and intersex groups are enacted on average across the OECD.

Ensuring the inclusion of all people in society is the driving force of the Paralympic movement, which seeks to empower people with disabilities through sport. Since the 1960s, the Paralympic games, and disability sports more broadly, have played a pivotal role in challenging stereotypes and discrimination towards people with disabilities around the world. In 2021, 163 countries and 4 537 athletes participated in the Tokyo Paralympic games, in contrast with the 23 countries and 400 athletes in Rome in 1960.

In education, inclusion is about both equity and equality. Understanding how different contexts and identities (e.g. gender, social class) combine to generate disadvantage, and removing the factors that lead to exclusion (e.g. attitudes, physical barriers), are crucial to providing a space where all individuals can recognise each other as equals.

Figure 4.8. Jumping hurdles: Sports and disability

Participation in the Paralympic Games, number of countries and athletes, 1960-2021



Source: Maueberg-deCasto, Campbell and Tavras (2016), "The global reality of the Paralympic movement: Challenges and opportunities in disability sports", https://doi.org/10.1590/S1980-6574201600030001; International Paralympic Committee (n.d), Tokyo 2020 Paralympic Games, https://www.paralympic.org/.

StatLink https://stat.link/1ctq80

And education?

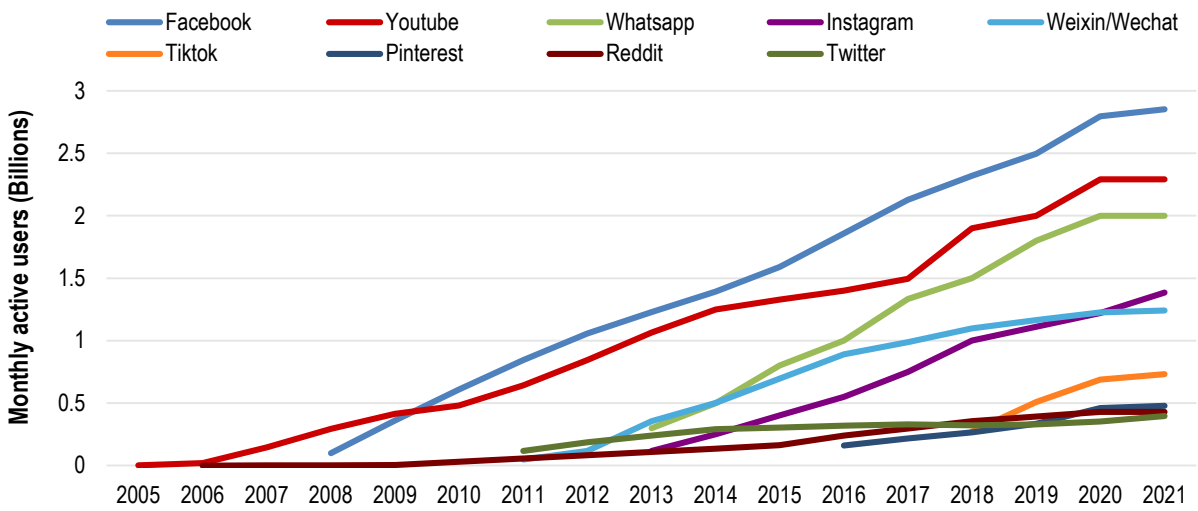
- What kind of school-level interventions, partnerships and services (e.g. resourcing, communication with families and communities, counselling services, digital technologies) can help teachers better support students' diverse needs? Their education-to-work transitions?
- The teacher workforce is often less diverse than the composition of students. How can education systems recruit and retain teachers from diverse backgrounds? Which policies are needed? Which barriers would need to be dismantled?
- Is education institutions' infrastructure adequate to serve the needs of all learners (including different learning, cognitive and physical abilities) in your system? Is non-formal learning accessible and inclusive to all? If not, how could education institutions help?

The many profiles of us

Digital communication technologies enable not only new ways to relate but also to construct, live and present our identities. While in the past our location and physical bodies anchored our identity and relationships, we can now create virtual profiles to suit any purpose and share these with anyone, anywhere. Social media and interest-based platforms have expanded exponentially, allowing users numerous tools with which to grow their networks and find support, express themselves, experiment with desired identities, and selectively self-present. However, these opportunities also raise questions about safety, transparency and the boundaries between exploration and manipulation. Education systems must learn to better leverage these new opportunities, while also helping individuals learn to ethically and responsibly participate in the digital environment.

Figure 4.9. I post, therefore I am

Number of monthly active users on social media platforms, 2004-2021



Note: Monthly active users (MAU) refer to active accounts and may not equate to unique individuals.
Source: OECD calculations from companies' annual reports; Ortiz-Espina (18 September 2019), https://ourworldindata.org//; Iqbal (13 May 2021), https://www.businessofapps.com/; Sherman (24 August 2020), https://www.cnbc.com/; Statista (2021), https://www.statista.com/.

StatLink https://stat.link/sictlv

Social media has exploded as a phenomenon. Since MySpace first passed 1 million users in 2004, monthly active users (MAUs) across social media platforms have grown to 4.66 billion users in 2021. Facebook alone has grown from 100 million users in 2008 to over 2.8 billion in 2020. Youtube and WhatsApp now have more than 2 billion MAUs each.

These users may be one individual with many profiles, as the unique characteristics of social media, and digital spaces more broadly, make it easy to turn these into multiple identities. Beyond mere aliases or duplicate accounts, reduced cues, such as limited images or selected written information, and asynchronicity allow users to control their self-presentation and experiment with new personas. From image filters to digital avatars, social media offers a range of ways to modify, hide or create traits.

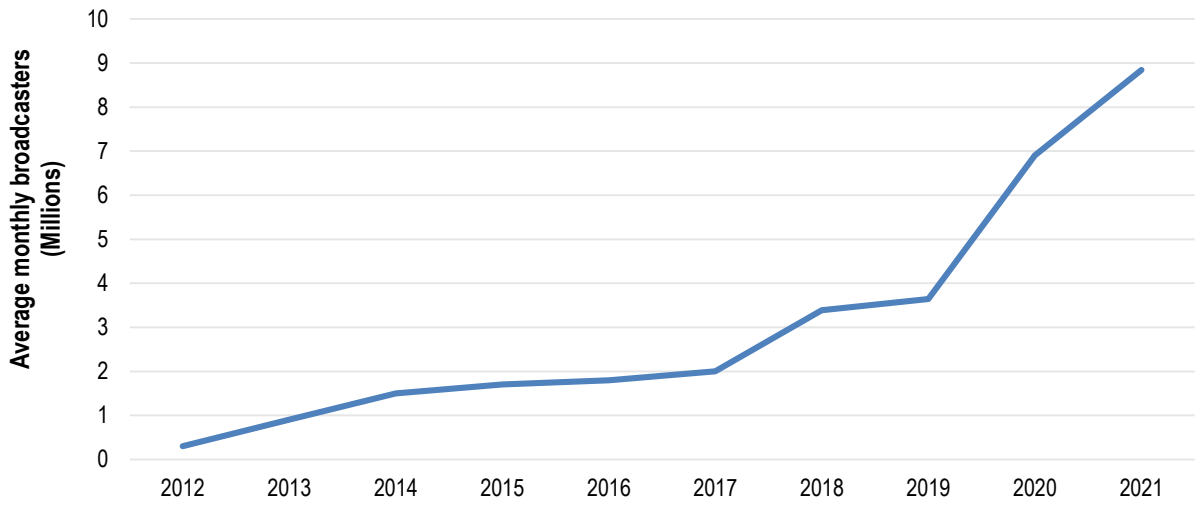
The internet further facilitates multiple identities by allowing users to pursue shared interests and even create careers. The live-streaming site, Twitch, allows users to film and share their activities, mostly video gaming, in real time. It has grown from 300 000 average monthly broadcasters in 2012 to over 8.84 million in 2021.

Social media can help diversify social networks by bringing people together across geographical, social and age divides. This allows people to find new affinity groups or test aspects of identity that might feel risky in person. However, it can also open doors to deception and abuse, such as scams, cyberbullying, or trolling. Social media often blurs the line between reality and performance, such as when influencers and streamers adapt their personas to attract audiences and advertising revenue.

How can education help cultivate ethical, informed and tolerant digital generations? And how can education institutions and professionals participate in this digital reality?

Figure 4.10. All the internet's a stage

Average monthly broadcasters on the live-streaming site Twitch, 2012-2021



Note: Average includes any streaming channels that were live at least once per month.
Source: Twitchtracker (2021), www.twitchtracker.com; Iqbal, M. (16 September 2021) "Twitch Revenue and Usage Statistics (2021)", https://www.businessofapps.com/.

StatLink https://stat.link/mseqfw

And education?

- Digital and physical identities are increasingly intertwining as technology permeates our daily lives. How can education support the development of identity and belonging, so important to well-being? What are the opportunities and risks emerging in this evolving context?
- Public policies and social practices (e.g. bans, time limits) in relation to children's use of digital technologies do not always align with evidence. How can schools and teachers disseminate evidence-informed best practice? How can they support learners and families to build digital skills and resilience?
- What opportunities and risks does technology pose for teachers' autonomy and leadership in student learning? How are decisions regarding technology purchases and platforms made in your system? How can teacher (and other school-level) voice and choice be incorporated?

What future for identity and belonging and education?

Trends allow us to consider what current patterns might mean for the future. But what about new patterns, shocks and surprises that could emerge over the next 15 to 20 years?

Building on the OECD Scenarios for the Future of Schooling, this section encourages readers to consider how growth could connect with education to evolve in multiple ways. Two vignettes illustrate possible stories: the Reader is invited to adapt and create new ones as desired. The next page sets out some key questions for education, and a set of potential shocks and surprises that could impact education and learning in unexpected ways. The descriptions of each scenario can be found in the Introduction of this volume.

Scenario 1 Scenario 2 Scenario 3 Scenario 4

"Beep beep beep!" shouts Ben happily. Leonora sighs. She's been pushing the two-year-old to use words instead of machine sounds to communicate. Leonora is an experienced early education professional, and this is not the first time that she sees a child who insists on acting like a robot. She's raised the issue at staff meetings, but so far she's struggled to be taken seriously. "Don't worry so much!" they say. "He'll grow out of it". But maybe now things will be different. After school, Leonora is meeting with teachers and parents of youth who are also choosing to identify with non-human intelligences. "First, we'll figure out how widespread this is" Leonora plans. "And then what it means for development". She smiles weakly. "Maybe it's not so bad after all. If their learning goals come from AI, academic development will definitely not suffer!"

For Julie, Life Skills has been a blessing this last year. Life skills – now version 11.1 – is a software that promises to develop the basic skills needed to get a decent-paying job in her district. But Julie cares less about jobs and more that she is finally old enough to stay home alone. Her mother never could afford to pay for a tutor, and Julie was forced to do her studies at the local learning centre, although not without trouble. "There was nothing about me they didn't make fun of", Julie remembers, "but enough is enough. Now I'm free". From today on, Julie will learn from home, and she can design her digital learning avatar any way she wants, so no one can see what she really looks like! "Enough is enough," she tells herself once more as she logs into her computer.

In 2040, things look quite different

Qualification, socialisation, care and credentialing arrangements may differ across alternative futures.

By 2040, how could the goals and functions of education be impacted by changes in:

- globalisation and human mobility?
- social diversity and cohesion?
- virtual and real-life identities?

What is expected from education?

Changing values, science and technology shape learning. In 2040…

- what type of competences are needed to support identity and belonging? How are they best learnt?
- to what extent is education institutionalised? With which consequences for equity?
- are there new structures for intergenerational exchange, mentoring and mutual learning?

How are space, content, time and relationships organised?

Who educates and in which conditions?

By 2040…

- are teaching activities and profiles more or less diverse?
- is teaching based on professional standards or is it more open access?
- do educational settings, such as nurseries, schools and universities, still exist in a physical format?

Who is responsible for what and accountable to whom?

Views on education differ across stakeholders, and so does their capacity to influence decisions. In 2040…

- what are the roles of government, market and civil society?
- is decision making transparent? Is it inclusive?
- in which ways does the geopolitical context affect the provision of education and learning?

Shocks and surprises

Despite the best laid plans, the future likes to surprise us. What would these shocks mean for education and learning if they came to pass? Can you see signs of other potential disruptions emerging?

Identity stacking

Each person has multiple identities, including bionic and other augmented elements, that they use to express themselves and take part in society

Multilingual by default

AI breakthroughs make real-time translation possible without human intervention

Democratic downturn

A coalition, with strong connections to civil society groups, is now in power claiming to represent "the people" while denying human rights for many

Alone, yet not lonely

Brain implants circumvent the feeling of loneliness, and social isolation has become a desired state

Find out more

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Glossary

- **Agency**: The capacity of individuals to act independently and to make their own free choices.
- **Asynchronicity**: Time delays inherent in many forms of mediated communication that give individuals more control over the messages they construct**.**
- **Civic engagement**: Means promoting the quality of life in a community, through both political and non-political processes.
- **Disability sports**: Sports played by persons with disabilities, including physical and intellectual disabilities.
- **Discrimination**: The unjust or prejudicial treatment of different categories of people, especially on the grounds of race, age, sex, or disability.
- **Exclusion**: A state in which individuals are unable to participate fully in economic, social, political and cultural life, as well as the process leading to and sustaining such a state.
- **Family reunification**: Foreigners admitted into a country because they are the immediate relatives of citizens or permanent residents in the receiving country or because they are the foreign fiancée(e)s or the foreign adopted children of citizens. The definition of immediate relative varies from country to country but generally includes the spouse and minor children of the person concerned.
- **Foreign-born population**: The foreign-born population of a country is all persons who have that country as the country of usual residence and whose place of birth is located in another country.
- **Fragmentation**: The absence or underdevelopment of connections between a society and the grouping of certain of its members.
- **Free movement areas**: Regions where border controls between states have been removed to allow for the free movement of people for work, leisure, residency and so on. The Schengen Area in the European Union and the ECOWAS in West Africa are two examples.
- **Global competence**: A multidimensional capacity that encompasses the ability to: 1) examine issues of local, global and cultural significance; 2) understand and appreciate the perspectives and worldviews of others; 3) engage in open, appropriate and effective interactions across cultures; and 4) take action for collective well-being and sustainable development.
- **Humanitarian migrants**: Persons who have been granted asylum and some sort of protection (e.g. refugee status) or have been resettled through programmes outside the asylum procedure.
- **Human rights**: The basic rights and freedoms that belong to every person in the world, from birth until death.
- **Influencer**: A person who can affect the behaviour and opinions of their followers on social media accounts, especially to generate interest in a trend, product or cause. Influencers often receive compensation (free products or payment) from companies for promoting their products.
- **Inclusion**: The process of improving the terms of participation in society, particularly for people who are disadvantaged, through enhancing opportunities, access to resources, voice and respect for rights.
- **Individualistic values**: Values that favour the **independence, self-reliance** and self-realisation of the individual over communal, societal, or national interests.
- **International migrant stock**: The total number of people who have changed their country of usual residence, who are present in a given country of destination at a particular point in time. This includes both permanent foreign-born populations as well as temporary ones, such as students and migrant workers.
- **Legal LGBTI+-inclusivity**: The extent to which a jurisdiction has enacted legal measures supporting the rights of people who are lesbian, gay, bisexual, transgender and intersex. Legal measures include general provisions, such as those protecting against discrimination and violence, and group-specific provisions, e.g. equal treatment of same-sex and different-sex consensual sexual acts.

- **Live-streaming**: Digital streaming media simultaneously recorded and broadcast in real time.
- **Marginalisation:** A complex process of relegating specific groups of people to the lower or outer edge of society.
- **Migration flows**: The number of migrants entering or leaving a given country during a given period, usually one calendar year.
- **Monthly active users (MAUs)**: The number of unique users who visit a social networking site within the past month. Monthly active users (MAU) refer to active accounts and may not equate to unique individuals.
- **Multilateral development organisation**: An organisation that is formed by three or more nations to work on issues that are relevant to each of them.
- **Non-political independent associations**: Non-political associations include all associations whose main purpose is not the change of policy or practice at the state or societal level, such as sport clubs and literary societies. An organisation is considered independent if it is not controlled by the state or the ruling party and membership is voluntary.
- **Political associations**: Political associations include all associations whose main purpose is the change of policy or practice at the state or societal level. It does not include political parties or trade unions.
- **Positive identities**: Elements of self-esteem, self-concept and self-belief enabling an individual to feel a sense of both individuality and belonging in the social context, to learn and acquire competencies and to achieve emotional well-being.
- **Reduced cues**: The lack of information, both sensory and general, in digital exchanges compared to face-to-face ones. This can be anything from limited views of body language and non-audio-visual input in a video call to the limited context in a chat or detail on a digital profile.
- **Regional development banks (RDBs)**: Multilateral institutions that provide financial and technical assistance for development in low- and middle-income countries within their regions.
- **Selective self-presentation**: The process of creating a digital artefact which is a carefully chosen representation or expression of one's real world self.
- **The Paralympic movement**: A movement started in 1948 to promote health, disability rights and social integration for athletes with disabilities.
- **Trade union density**: The number of net union members (i.e. excluding those who are not in the labour force, unemployed and self-employed) as a proportion of the number of employees.
- **Trolling**: Refers to a deliberately offensive or provocative online posting with the aim of upsetting someone or eliciting an angry response from them.
- **Victimisation**: An act that victimises or exploits someone.
- **Voter turnout**: The percentage of eligible voters who cast a ballot in an election.

5 Our changing nature

Our connection to the natural world has profoundly evolved throughout history. Education can play a key role in helping us nurture healthy and sustainable relationships with ourselves and our surroundings. This chapter explores these issues through five themes:

- **There is no Planet B**: highlights the unsustainable pace at which we are consuming natural resources.
- **The natural world**: explores efforts to protect natural ecosystems in the face of an increasingly urban population.
- **Food for thought**: discusses trends in food production and consumption.
- **Our human body**: examines progress in medicine and human enhancement technologies.
- **No one lives in cyberspace**: highlights the growth of digital communication and reality, but reminds us that a hug emoji is not the same as a hug.

These trends are linked to education and its future through a series of questions and scenarios. Potential implications of COVID-19, both immediate- and longer-term, are discussed.

Overview and impact of COVID-19

As our lives become increasingly virtual, we need to reconsider the relationship we have with the physical world and our physical selves. We have seen the impact of climate change: the Earth is warming, sea levels are rising and seasons as we know them are slowly vanishing. Heat waves and wildfires are increasingly making summers "no go zones" for entire regions. Human well-being is intrinsically intertwined with caring for our planet. And not just on a global level: in a touch-less society, we cannot forget the benefits of physical contact and face-to-face encounters. "To touch is to give life" said Michelangelo. This was later validated by science: premature babies gain weight when rubbed lightly from head to foot. Education can help foster a thriving relationship with our own minds and bodies, with other human beings and with the natural world.

Our changing nature & COVID-19

The COVID-19 pandemic is a reminder that, despite our best laid plans, the future likes to surprise us. Trends can accelerate, bend and break. As the shock subsides, open and important questions emerge about the long-term effects of these shifts.

ACCELERATE

Will we reshape our cities into more sustainable, resilient and livable places?

In the wake of the pandemic, many cities around the world reclaimed urban space, prioritising interventions to support non-motorised transport, like pop-up cycle lanes, free bike-share use, e-bike subsidies and traffic calming measures. Several cities are now considering turning this emergency infrastructure into permanent fixtures.

Paris introduced 29 km of pop-up cycle lanes and 4 km of traffic calming streets

Brussels implemented a 25 km cycle lane, a 23 km traffic calming road, a 5 km car ban and a 20 km/h speed limit

Mexico City introduced 54 km of new cycle lanes

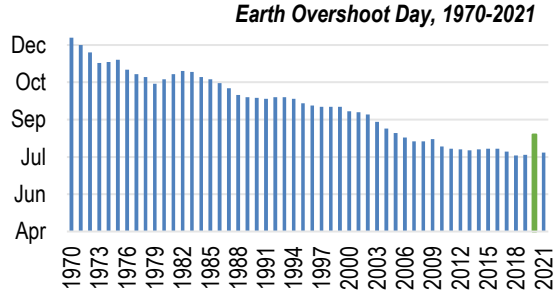
Nikitas et al. (2021), https://doi.org/10.3390/su13094620

BEND

Can we live within the resource capacity of the Earth?

Earth Overshoot Day marks the date when our demand for natural resources exceeds what Earth can supply in any given year. While we made it to December in 1970, we now outstrip Earth's capacity by July. Shutdowns due to COVID-19 delayed the date in 2020, but the gains were short-lived. Can we build sustainable consumption habits to bend or reverse this trend?

Earth Overshoot Day, 1970-2021

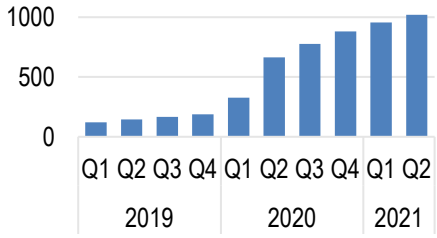


Global Footprint Network (2021), https://www.overshootday.org/

BREAK

Is physical distancing here to stay?

Zoom quarterly revenues (million dollars)



Zoom (2021), https://zoom.us/

So far… yet so close?

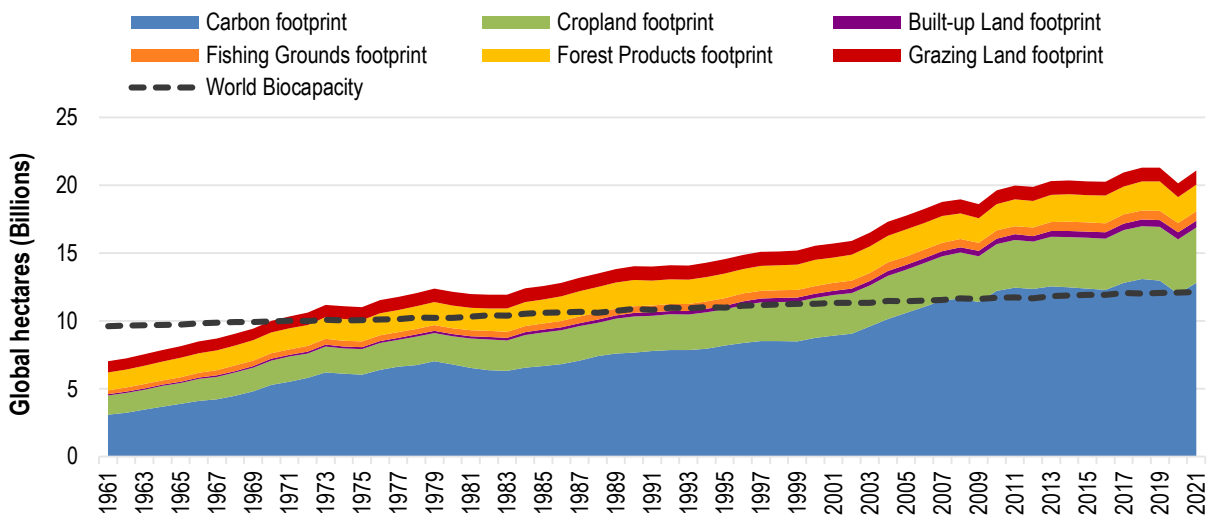
In the face of multiple lockdowns and other social distancing measures, online platforms like Zoom enabled a new virtual togetherness**.** Virtual happy hours, coffee breaks and physical exercise classes, among others, popped up in our agendas. Which virtual interactive practices will endure? Will the digital challenge the non-digital?

There is no Planet B

Earth is the only place in the universe known to harbour life (at least for the moment). The oldest known fossils are around 3.5 billion years old, and a number of discoveries suggest that life on Earth may have appeared even earlier. But while Mother Nature is bountiful, even she has limits. Human consumption of natural resources currently exceeds the capacity of the planet, and we now find ourselves in 'ecological debt'. The interest we are paying on this compounding balance – from soil erosion to the build-up of CO_2 in the atmosphere – comes with huge costs now and for the generations to come. Education is key to building green skills and the understanding of the importance of acting urgently to ensure long-term sustainability.

Figure 5.1. An outsized ecological footprint

Humanity's ecological footprint by land type against Earth's biocapacity, global hectares (gha), 1961-2021



Note: Historical data for 1961-2017; Projected data for 2018-2021.
Source: Global Footprint Network (2021), *National Footprint and Biocapacity Accounts*, https://data.footprintnetwork.org; Lin, Wambersie and Wackernagel (2021), "Estimating the Date of Earth Overshoot Day 2021", https://www.overshootday.org/.

StatLink https://stat.link/notb20

Humans have been shaping the face of Earth for centuries. Since 1970, our ecological footprint has consistently exceeded Earth's biocapacity. In 2021, we exceeded it by over 70%, which means that globally, we lived as if we had 1.7 planets available instead of only one. Rates of consumption vary by country: for example, the United States consumes as if it had five Earths available, France three and Colombia slightly over one. On average, OECD countries consume the equivalent of over three Earths.

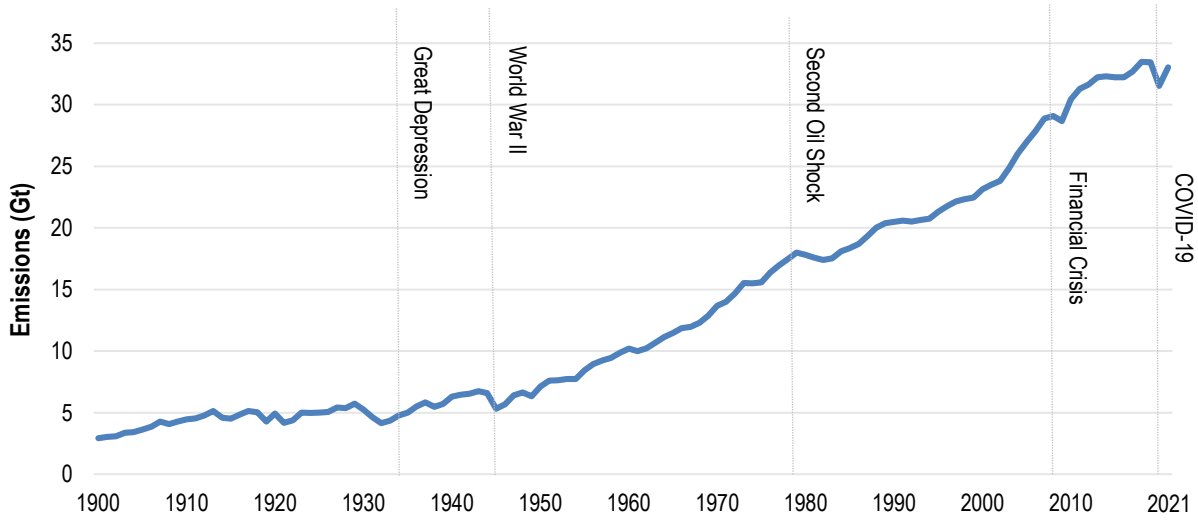
Earth Overshoot Day marks the date when humanity's demand for natural resources in a given year exceeds Earth's biocapacity for that year. While in 1970 Earth Overshoot Day fell on 30 December, in 2021 it fell on 29 July. This gap between human consumption and nature's capacity to meet our demands cannot be sustained indefinitely. Unless our footprint gets smaller (or another liveable planet is found), stocks will eventually run out and humanity as a whole will have to pay the price.

The carbon footprint is the fastest-growing component and the lion's share - currently 60% - of our ecological footprint. Global energy-related CO_2 emissions reached an all-time high of over 33 gigatonnes (Gt) in 2019, over 11 times the amount of emissions in 1900.

In 2020, CO_2 emissions reached the highest-ever average annual concentration in the atmosphere – around 50% higher than when the industrial revolution began. Global warming, severe drought, rising sea levels, extreme weather events, increased wildfires, and food and water supply disruptions are only some of the consequences. If current trends continue, this frightening list is expected to get longer. Education is key to shifting course, with R&D systems developing technological solutions and classrooms working to empower students to take action in the global fight against climate change.

Figure 5.2. CO_2de red

Global energy-related CO_2 emission, gigatonnes (Gt), 1900-2021



Source: IEA (2020), *Global Energy Review 2020*, https://www.iea.org/reports/global-energy-review-2020; IEA (2021), *Global Energy Review 2021*, https://www.iea.org/reports/global-energy-review-2021.

StatLink https://stat.link/q5yaev

And education?

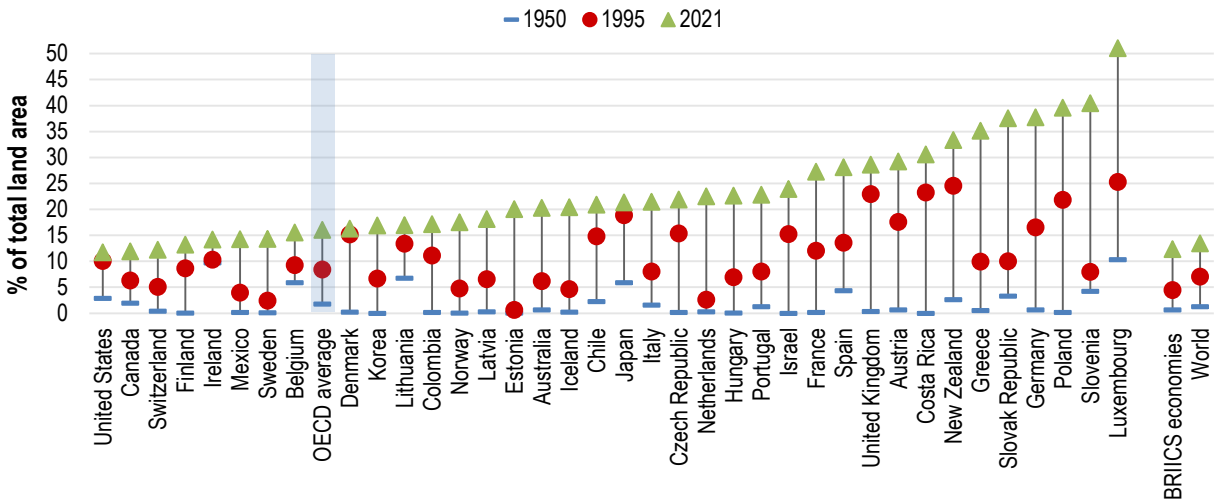
- How well do young people develop an awareness of the connection between their daily decisions and possible long-term consequences, not just for themselves but for society as a whole? How can education systems support this understanding, and the behaviour changes needed to make a difference?
- How are extreme weather events due to climate change (e.g. heatwaves and floods) affecting your education system? How might they in five or ten years? What schooling arrangements (e.g. calendar, schedules) and resources (e.g. infrastructure, transport) need to adapt?
- How might climate change affect the inequalities present in your education system? Would you expect them to increase, decrease, or shift? What can be done to reduce current and expected inequalities?

The natural world

From ancient times to the present, the calming and healing powers of nature have been well documented. Yet natural spaces are shrinking as our cities and populations grow. Biodiversity is being lost at an accelerating rate, with 25% of all plant and animal species now threatened with extinction. In an attempt to restore our broken relationship with nature, we are increasingly setting aside protected areas on both land and sea. In addition, cities are slowly becoming greener, with everything from rooftop gardens, beekeeping and urban farms emerging to help protect biodiversity and ensure city-dwellers have adequate opportunities for exposure to nature. Given the importance of time spent outdoors in contact with nature for health and development, how can education contribute to connecting learners with the natural world?

Figure 5.3. Nature first

Protected areas (terrestrial), % of total land area, 1950, 1995 and 2021



Note: OECD average includes all member countries except Turkey, as no data are submitted for Turkey. BRICS economies include Brazil, Russia, India, Indonesia, China and South Africa.
Source: OECD (2021), *Protected areas* (dataset), https://stats.oecd.org/.

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The world is facing its sixth mass extinction event, with a 68% drop in populations of mammals, birds, reptiles, amphibians and fish on average since 1970. One million plant and animal species are currently threatened with extinction. This ongoing decline of biodiversity has profound implications, from jeopardising climate-change mitigation, food and water security to increasing the likelihood of infectious diseases outbreaks.

To combat this, there have been concerted efforts to designate protected terrestrial and marine areas. Protected *terrestrial* areas have increased more than nine-fold between 1950 and 2021, now covering on average 16% of land area in OECD countries. Twenty-seven OECD countries currently meet the Convention on Biological Diversity *Aichi* target to protect at least 17% of their land area. In addition to safeguarding natural spaces on land, there has also been progress in protecting *marine* areas. Between 2000 and 2021, protected marine areas increased from only 3% to more than 21% of total area. Yet, large variations persist among countries both in the extent and effectiveness of nature protection.

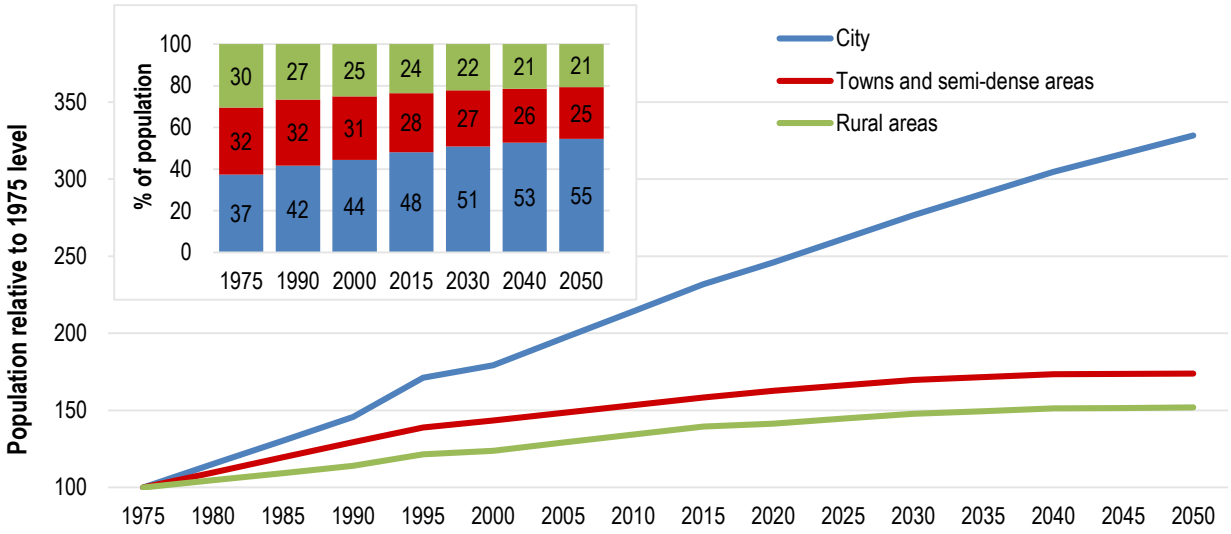
The world increasingly lives in cities, with urban population rising from 1.5 to over 3.5 billion since 1975. This growth is projected to continue, increasing to 5 billion by 2050, while at the same time the share of

population in towns and rural areas is expected to continue to fall. But the future is not just grey: new and innovative ways to incorporate green spaces into urban structures are being developed, including rooftop gardens, vertical forests, pocket-parks, urban beekeeping and urban farming.

Green urban spaces can have a multitude of benefits, from improving air quality, protecting biodiversity and helping keep cities cool. They can also help inject life into urban centres, making room for play and social interaction while potentially reducing social isolation. Engaging students in growing their own food in school gardens, promoting food waste reduction and composting activities in schools can help re-connect urban residents with the natural world. Education, outdoor learning and daily access to nature are key to helping students thrive while they learn about, value and grow with our natural world.

Figure 5.4. Urban jungles

Changes in global population by degree of urbanisation, population in 1975=100, 1975-2050



Note: Historical data used for 1975-2015. Projections are from 2016-2050.
Source: OECD/European Commission (2020), *Cities in the World: A New Perspective on Urbanisation*, https://doi.org/10.1787/d0efcbda-en.

StatLink https://stat.link/m2fzti

And education?

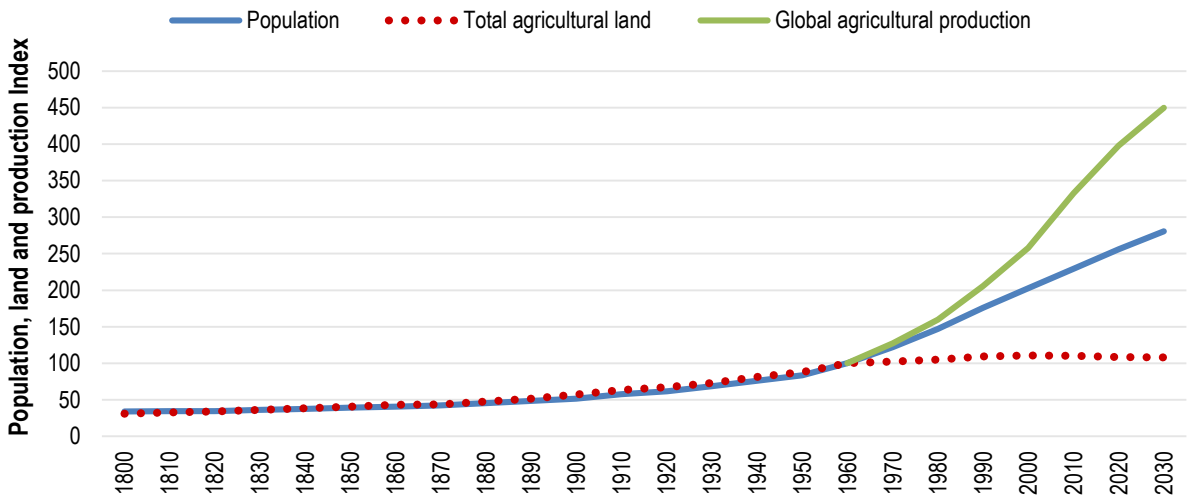
- Regular connection to nature has many benefits for learning and well-being. How can education systems ensure that these benefits reach all students, even those in the densest urban centres? What kind of partnerships, resources and pedagogies are needed? Can you experience nature in a virtual environment, or is that a contradiction in terms?
- Is the environment in and surrounding education institutions always healthy or, indeed, “natural”? How can urban planning, design and regulation contribute to ensuring safety and well-being in education institutions and their communities?
- Is teaching in rural areas and multi-grade classrooms – typical of small rural schools – part of all teachers’ pre- and in-service education? Could this improve the pedagogical repertoire of urban teachers while helping attract and retain teachers in rural areas?

Food for thought

Humanity today faces a 'triple challenge': ensuring global food security and nutrition, sustaining the livelihoods of millions of people involved in the food chain, all while combatting environmental pressures due to agriculture. Yet not only are we steadily outstripping land capacity, we are also eating more unhealthy highly processed foods. Developments of innovative systems and technologies – such as agroecology and smart farming – aim to reinforce the sustainability of food systems, contributing to more efficient land use at the same time as they protect and enhance the natural resource base. But will we be able to break our love of ultra-processed foods? Education plays a role in ensuring all students have access to nutritionally balanced diets. It can also support the development of strong health literacy while raising awareness of the social and environmental implications of food production and consumption.

Figure 5.5. Growing more with less

Population, food production and agricultural land, World, 1800-2030, 1960=100



Note: Data for 2020-2030 are projections. Agricultural production data start from 1960. Agricultural land data include crops and pasture.
Source: OECD (2021), *Making Better Policies for Food Systems*, https://doi.org/10.1787/ddfba4de-en.

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Over the last centuries, agricultural land development and use have grown along with our population. But agricultural land is not only finite, it is also a major driver of deforestation, habitat loss, soil erosion and agriculture-related greenhouse gas emissions. Since 1960, food production and land use have been increasingly decoupled, with food production more than tripling while agricultural land volume has grown by only 10-15%. This decoupling was initially achieved through more intensive use of inputs such as fertilisers, pesticides and irrigation water. Since the 1990s, growth in food production has increasingly been driven by greater efficiency and productivity.

While not yet a silver bullet, alternative approaches to intensive agriculture such as conservation agriculture, agroecology and data-driven precision agriculture have emerged. These approaches all aim to continue increasing food production capacity while also improving its environmental sustainability.

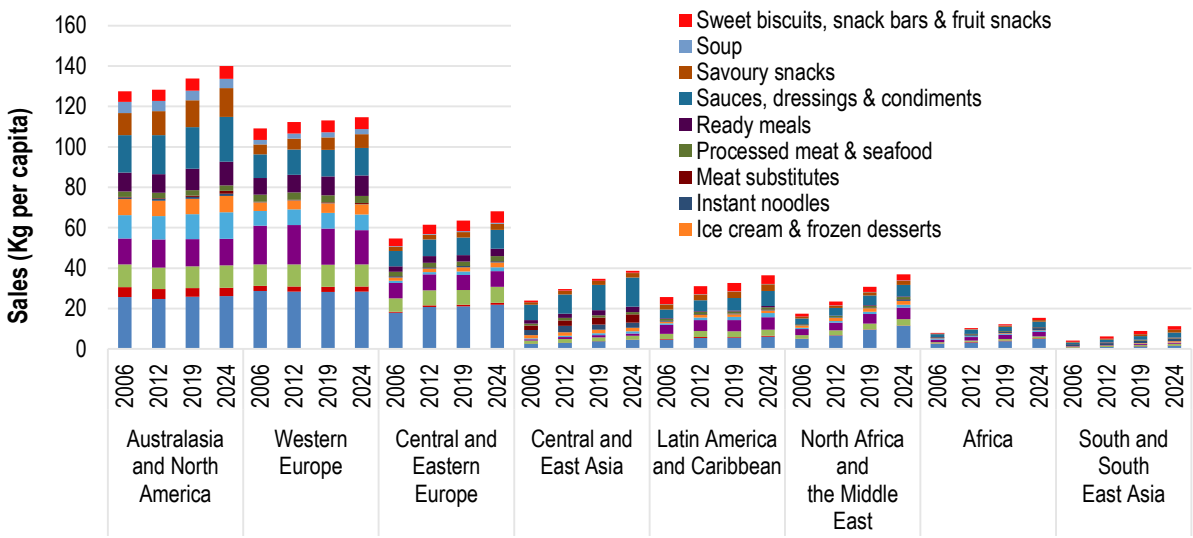
The industrialisation and globalisation of food systems have helped drive the growth of ultra-processed food in human diets. New food production and processing technologies have enabled long-distance transportability, longer shelf-life and even entirely new product categories, such as microwaveable popcorn. Per capita sales of ultra-processed food are rising worldwide, and are highest in Australasia,

North America and Western Europe. In middle-income countries, where sales growth has been (and is projected to remain) rather high, absolute sales volume is approaching equivalency with that of high-income economies.

While processed food can support safe, affordable and nutritious diets, the regular or excessive consumption of energy-dense and nutritionally poor ultra-processed food - rich in sugars, salt, oils and fats - is associated with higher prevalence of obesity, cancer and other non-communicable diseases. Education is key to teaching students healthy nutrition and fostering nutrition equity.

Figure 5.6. Would you like salt with that?

Annual sales of ultra-processed food across world regions, kilograms per capita, 2006, 2012, 2019 and 2024



Note: Data for 2024 are projections.
Source: Baker et al. (2020), "Ultra-processed foods and the nutrition transition: Global, regional and national trends, food systems transformations and political economy drivers", https://doi.org/10.1111/obr.13126.

StatLink https://stat.link/iygwp9

And education?

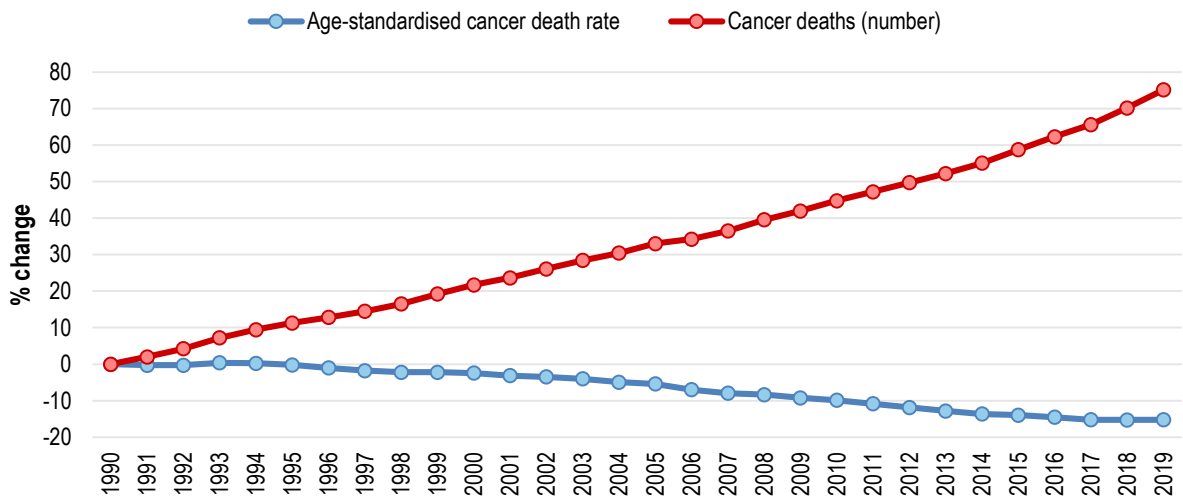
- How effective are school initiatives such as "Meat-free Mondays" in shaping students' eating habits and understanding of sustainability issues? Can education institutions in your system do more to tackle food waste?
- Advertising for "junk food" often targets people in sophisticated ways. How can education prepare all individuals to make informed eating choices, especially vulnerable students and families with less access to or awareness of healthy options? How can it help learners recognise the relationships between food and emotional well-being?
- Before a context or situation, pedagogues always ask "what can we learn from this?". Can school canteens be a space for learning life skills such as cooking and healthy eating? Should students serve their school community by preparing the meals?

Our human body

Rene Descartes said "I think, therefore I am". But where would we be without our bodies? From more effective treatments for cancer to fully sequencing the human genome, medicine is helping us live longer and healthier lives. But this is just the beginning: advanced human-machine interfaces, implants, drugs and genetic modification all increasingly enable humans to enhance their physical, cognitive and emotional selves. A growing number of biotech companies are even trying to cure ageing, further pushing boundaries in the search for the elusive elixir of the fountain of youth. However, while opening up tremendous possibilities, human enhancement is also raising important ethical challenges and questions about what it means to be human. Education is key to helping us think through these ethical challenges, taking into account individual versus collective well-being.

Figure 5.7. The art of medicine

Change in two measures of cancer mortality, World, 1990-2019



Source: IHME (2019), *Global Burden of Disease*, GBD Results tool, http://ghdx.healthdata.org/gbd-results-tool.

StatLink https://stat.link/3gl4hu

The past century has seen a significant improvement in average life expectancy around the globe, although progress has slowed down in recent years in many countries. Importantly, gains in life expectancy have been largely in good health. For major causes of death like cancer, the raw numbers of deaths have increased as the population has grown and aged. But improved treatment and better awareness and prevention have been key to reducing the overall probability of cancer death: when controlling for population ageing, death rates have indeed decreased by 15% between 1990 and 2019.

Yet, challenges remain for further raising the quality of life in our elder years. Despite billions of dollars spent on dementia-related disorders, for example, medicine is still struggling to find a cure for these and other neuro-degenerative diseases, expected to become increasingly prevalent as our societies age.

In addition to medical progress on disease, targeting the ageing process itself has gained momentum in the past two decades. There is a growing investment in and market for anti-ageing science, with the number of ageing biotech firms increasing from only two companies in 1999 to 161 by 2020.

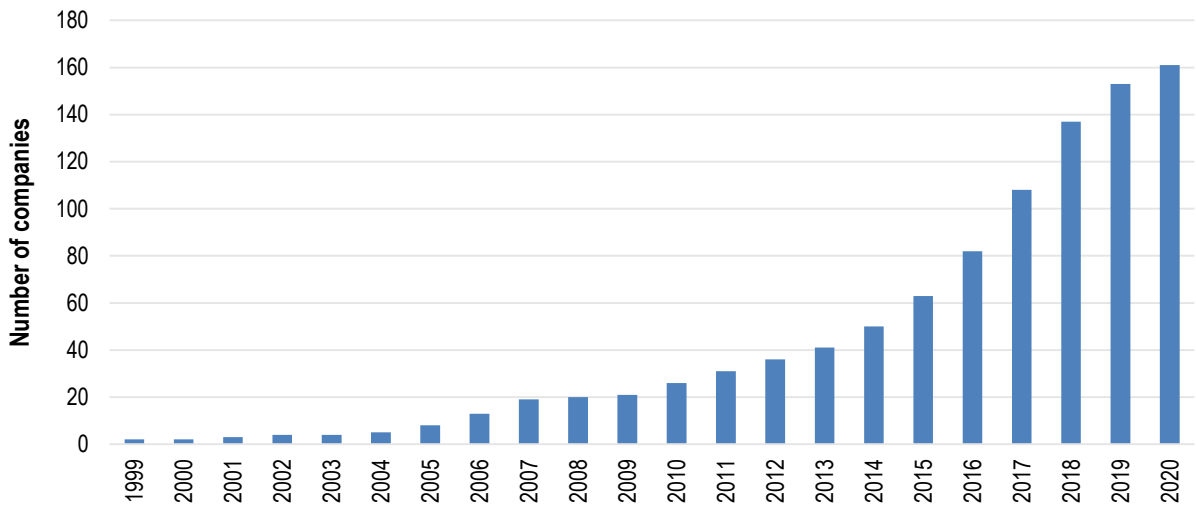
These companies aim to impede ageing by intervening with the biological changes driving the process – something that, if successful, has led some futurologists to claim humans could eventually live

forever. Pushing human biological boundaries, whether through long-life elixirs or other human enhancement technologies, may radically redefine terms such as health and illness, treatment and enhancement, normality and abnormality.

Will we ever conquer ageing, or is ageing built into our genes? Will people have the option to change themselves and their children in ways that, until now, have only existed in superhero cartoons? What will this mean for education and lifelong learning?

Figure 5.8. Forever young: Augmented humanity

Cumulative number of ageing biotech companies, 1999-2020



Note: Only companies with an explicit self-described focus on ageing or where the core platform or technology seems to have the capability to treat (for therapies) and/or measure (for diagnostics) an aspect of ageing are included. Palliative effects to compensate for ageing are excluded.
Source: AgingBiotech (2021), *Aging companies dataset*, https://agingbiotech.info/companies/.

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And education?

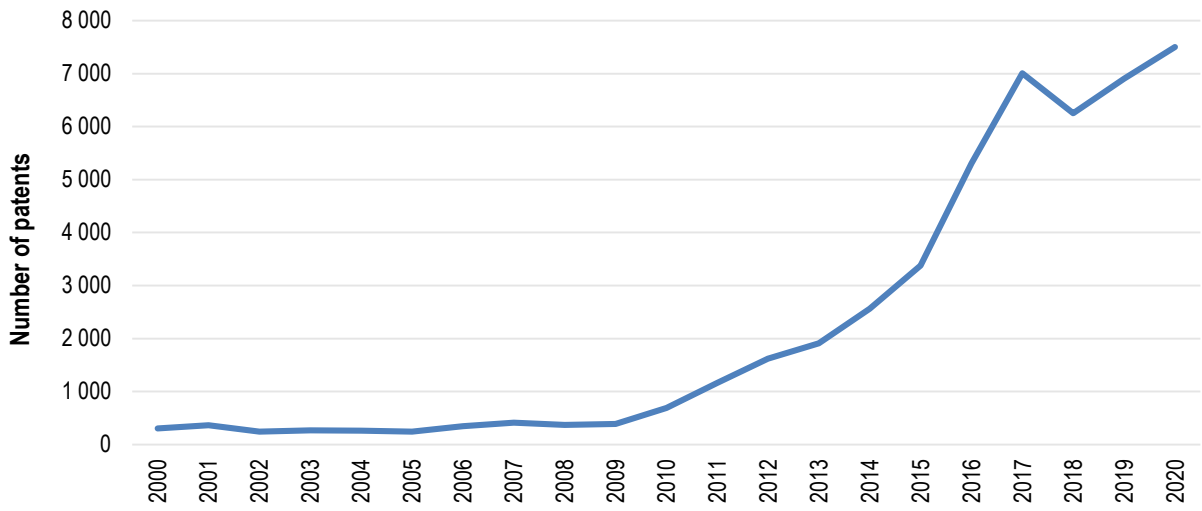
- Evolving technologies promise powerful ways to support students with special education needs. What kinds of partnerships between education systems and developers could speed up and secure access to these benefits for all students in need of them?
- Can we ensure equity in an era of human enhancement? For instance, what should we do if some students have access to competitive advantages via technology or smart drugs while other students don't?
- Increasingly sedentary lifestyles are linked to rising rates of obesity, mental illness and chronic disease. Observing trends in technology use and gamification, can you imagine schools including physical exercise in homework via smartphone apps and games?

No one lives in cyberspace

As our lives become increasingly virtual, the ways in which we communicate and interact are changing. Billions of emojis are sent every day to express love, thanks, congratulations and an almost infinite set of emotions or ideas. Over the last decade, tech giants such as Facebook, Google and Microsoft have invested billions in augmented and virtual reality technology. Bringing the digital world into the physical, immersive technology can transform everything from how we socialise to how we choose our clothes, furniture and even houses. But even though more activities can be performed online, nobody really lives in cyberspace. Human beings are innately social creatures, in need of physical touch. As the line between the real and virtual blurs, how can education help people thrive in an increasingly hybrid world?

Figure 5.9. Where the (virtual) wild things are

Global number of new patents/applications related to AR/VR in gaming, 2000–2020



Note: Data for 2019-2020 are forecasted.
Source: MaxVal Group, Inc. (19 August 2020), "Tracking Influential Augmented and Virtual Reality Patents In Gaming", https://www.maxval.com/.

StatLink https://stat.link/uve6ki

Augmented and virtual reality (AR/VR) is transforming the way we experience the world, altering what we can see, hear and feel. Gaming makes important use of this technology, with the number of new patents related to AR/VR exploding globally between 2010 and 2020.

Augmented reality can make the gaming experience more exciting by superimposing virtual images on real surroundings - Niantic's *Pokémon Go* being a great illustration. AR is now integrated into thousands of smartphone apps, allowing consumers to see everything from how furniture will look in their rooms to the effect of makeup items before purchase. Millions of people currently use AR when they apply filters to their Snapchat or Instagram stories.

In contrast, virtual reality creates a completely new, artificial environment to inhabit. Soon, VR tools such as Facebook Oculus may even allow people to attend meetings in virtual offices. However, social interactions still remain fundamental even within an augmented or virtual reality. Efforts are underway to include more social elements within this technology – as especially VR is still profoundly isolating.

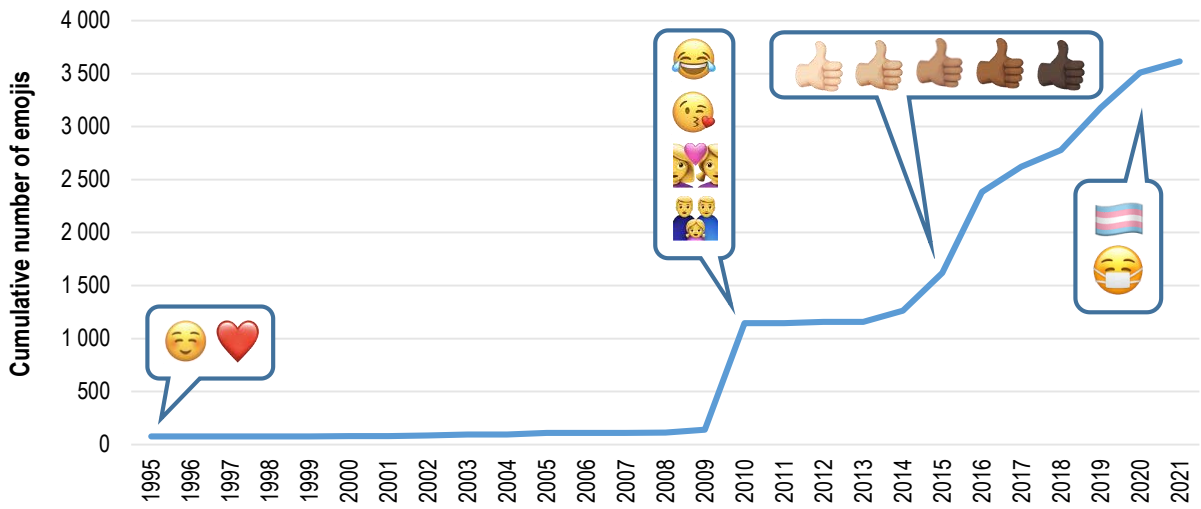
In 2015, for the first time in history, a non-word won the title of "word of the year". It was the 😂 emoji, which Oxford Dictionaries felt best reflected the ethos, mood and preoccupations of that year.

This is emblematic of how emojis are increasingly part of our social interactions. Their numbers are increasing, with 3 616 emojis formally recognised in 2021, an increase of over 200% since 2010. They are also becoming more inclusive, now covering different skin colours, diverse family structures and gender identities.

As a growing share of our daily communication takes place in digital environments, emojis help translate our physicality, from body language to emotions, to the virtual realm. Yet although they can help with human bonding, we can all admit that a hug emoji is not the same as a hug. Physical learning environments and face-to-face interactions remain crucial to help students of all ages learn how to learn, play and work together.

Figure 5.10. A picture is worth a thousand words

Number of emoji characters by year of addition to Unicode standard and notable emojis, 1995-2021



Note: The count excludes isolated emoji components, e.g. skin tone modifier. All emoji before 2010 are proleptic (only later considered emojis).
Source: OECD calculations from Buchholz, K. (2021), https://www.statista.com/; and Unicode Consortium (2019), http://www.unicode.org/emoji/charts-12.0/emoji-versions.html and (2021), https://unicode.org/emoji/charts/emoji-versions.html.

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And education?

- Hybrid learning, blending virtual and physical activities, may be here to stay. What kinds of implications could this have, e.g. for diversity and personalised learning? How can it be used to improve education quality and equity? What kind of infrastructure and support is needed?
- Learning is a social process and, with the sudden shift to remote learning due to COVID-19, many university students emphasised the importance of interaction and social experience. Returning to the basics, what is best for learning, and does this include remote learning? Does the answer change depending on the level of education?
- EdTech and digital educational materials and software are an increasingly important market. Who should be responsible for determining content and monitoring the quality of these products? What does accountability look like in a global digital world?

What future for our changing nature and education?

Trends allow us to consider what current patterns might mean for the future. But what about new patterns, shocks and surprises that could emerge over the next 15 to 20 years?

Building on the OECD Scenarios for the Future of Schooling, this section encourages readers to consider how growth could connect with education to evolve in multiple ways. Two vignettes illustrate possible stories: the Reader is invited to adapt and create new ones as desired. The next page sets out some key questions for education, and a set of potential shocks and surprises that could impact education and learning in unexpected ways. The descriptions of each scenario can be found in the Introduction of this volume.

Scenario 1 Scenario 2 Scenario 3 Scenario 4

Sheltering against the harsh sun, Ilayda sets out for the education centre, where she coordinates learning activities for the city's West Corner. The heat and drought are expected to continue through the autumn and all outdoor activities are cancelled. "We have to push back the learning calendar again" she frowns. Ilayda remembers when the school year lasted nine months, and lessons took place even during the hottest part of the day. She has managed to reschedule her 1-on-1 sessions with students to a new building with the capacity to keep cool despite no air conditioning, fully banned since 2034.
Otherwise, Ilayda continues to prioritise partnerships with community experts and professionals, which allows her to shift her role towards more coordination and less direct teaching. As she always says, "the world is changing, and schools need to keep up!"

"It felt like I was competing against a super-hero" Marc complains to his AI assistant. Yesterday, he participated in a VR competition for his Get Fit module. He finished second, far behind Divya, who competed while enhanced with EPO-producing mRNA molecules able to increase muscle oxygenation. When challenged, the VR ethical referee ruled that this type of enhancement complied with community guidelines, and let the results stand. "The VR community should add an option to let you know if your competitors will be enhanced, and how" says Marc, upset. "There would still be issues, such as how to trace invisible pre-natal genetic enhancements, but it's a start". The Global Summit on the Recognition of Human Augmentation Standards will take place next month in Beijing, and everyone hopes it will finally bring a degree of standardisation to the matter.

In 2040, things look quite different

Qualification, socialisation, care and credentialing arrangements may differ across alternative futures.

By 2040, how could the goals and functions of education be impacted by changes in:

- urbanisation and the environment?
- physical and mental health?
- new types of social and human interactions?

What is expected from education?

Changing values, science and technology shape learning. In 2040…

- has virtual reality transformed human interaction and social spaces, including those for learning?
- does the division between science-technology and humanities-arts still exist?
- are students able to spend more time in nature?

How are space, content, time and relationships organised?

Who educates and in which conditions?

By 2040…

- are teaching activities and profiles more or less diverse?
- is teaching based on professional standards or is it more open access?
- do educational settings, such as nurseries, schools and universities, still exist in a physical format?

Who is responsible for what and accountable to whom?

Views on education differ across stakeholders, and so does their capacity to influence decisions. In 2040…

- what are the roles of government, market and civil society?
- is decision making transparent? Is it inclusive?
- in which ways does the geopolitical context affect the provision of education and learning?

Shocks and surprises

Despite the best laid plans, the future likes to surprise us. What would these shocks mean for education and learning if they came to pass? Can you see signs of other potential disruptions emerging?

Enhanced humans

Pharmacology and human-machine interfaces allow us to enhance cognitive functions and modify emotional states at will, including our sense of what is morally acceptable (moral bioenhancement)

Planets B, C and D

Massive technological advancements have permitted humans to colonise the moon, Mars and even send out pioneers to Venus

Supercentenarians

Breakthroughs in anti-ageing technologies increase average life expectancy to 110 years

Climate refugees

Almost half of the world population has now acquired the status of climate refugees and is protected under international law

Find out more

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Glossary

- **Age-standardised cancer death rate**: Weighted average of the age-specific cancer mortality rates per 100 000 persons, where the weights are the proportions of persons in the corresponding age groups of the WHO standard population. It is a summary measure of the death rate that a population would have if it had a standard age structure.
- **Agroecology**: A holistic and integrated approach that simultaneously applies ecological and social principles to the design and management of sustainable agriculture and food systems. It seeks to optimise interactions between plants, animals, humans and the environment while also allowing people to exercise choice over what they eat and how and where it is produced.
- **Augmented and virtual reality (AR/VR)**: Augmented reality is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information. Virtual reality is a simulated experience that can be similar to or completely different from the real world.
- **Biodiversity**: The global variety of species and ecosystems and the ecological processes of which they are part, covering three components: genetic, species and ecosystem diversity.
- **Carbon footprint**: A measure of CO_2 emissions associated with fossil fuel use. In Ecological Footprint accounts, these amounts are converted into biologically productive areas necessary for absorbing CO_2. It is part of the ecological footprint because it is a competing use of bio-productive space: increasing atmospheric CO_2 concentrations are considered to represent growing ecological debt.
- **Conservation agriculture**: Conservation Agriculture is a farming system that promotes minimum soil disturbance (i.e. no tillage), maintenance of a permanent soil cover and diversification of plant species. It enhances biodiversity and natural biological processes above and below the ground surface.
- **Convention on Biological Diversity *Aichi* target**: The Convention on Biological Diversity is an international treaty for the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of resource benefits. It was ratified by 196 nations at the Earth Summit in Rio de Janeiro in 1992. Target 11 of the convention states that by 2020 at least 17% of terrestrial and inland water areas and 10% of coastal and marine areas will be conserved.
- **Earth's biocapacity**: The Earth's capacity to produce biological resources used by people and to absorb waste material generated by humans, under current management schemes and extraction technologies.
- **Ecological footprint**: A measure of how much area of biologically productive land and water an individual, population, or activity requires to produce all the resources it consumes and absorb the waste it generates, using prevailing technology and resource management practices.
- **Energy-related CO_2 emissions**: Emissions related to the combustion of fossil fuels (liquid fuels, natural gas and coal) and emissions associated with petroleum feedstocks.
- **Emojis**: Digital pictographs (pictorial symbols) that are typically presented in a colourful form. They represent things such as faces, weather, vehicles and buildings, food and drink, animals and plants, or icons that represent emotions, feelings, or activities.
- **Global hectares (gha)**: A biologically productive hectare with world average biological productivity for a given year. It allows researchers to report both the biocapacity of the Earth or a region and the demand on biocapacity (the Ecological Footprint).
- **Human-machine interfaces**: A user interface or dashboard that connects a person to a machine, system, or device. Common current examples include touchscreens and keyboards.
- **Life expectancy**: A measure of how long on average a person of a given age can expect to live, if existing death rates do not change.

- **Nutrition equity**: The principle according to which everyone should have the same opportunity of access to an adequate diet that is healthy, nutritious, affordable and culturally appropriate, regardless of their race, gender, ethnicity or postal code.
- **Pocket parks**: Small urban open spaces usually no more than 1 000 square metres that provide a safe and inviting environment for surrounding community members. They serve a variety of functions including small event space, play areas for children and areas for relaxing or meeting friends. They are also known as parkettes, mini-parks or vest-pocket park.
- **Precision agriculture**: A pioneer technique that provides farmers with near real-time analysis of key data about their fields. Paving the way for full automation of farms, this technique uses big data analytics to provide productivity gains through an optimised use of agriculture-related resources including savings on seeds, fertiliser, irrigation and even farmers' time.
- **Protected areas**: A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.
- **Sequencing the human genome**: The human genome is the operating manual containing all the instructions that help a single cell develop into a human. It guides human growth, helps organs do their jobs and repairs itself when it becomes damaged. It is a collection of long polymers of DNA, an extremely large molecule that looks like a long, twisted ladder. Sequencing the human genome means determining the order of the four chemical building blocks - called bases - that make up the DNA molecule.
- **Sixth mass extinction event**: An ongoing extinction event of species during the present Holocene epoch (with the more recent time sometimes called Anthropocene) as a result of human activity. It is also called the Holocene extinction.
- **Smart farming**: Applying information and data technologies for optimising complex farming systems. The focus is on access to data and how farmers can use the collected information intelligently, with the goal of producing more and better food with less investment and the same amount of land.
- **Ultra-processed food**: Products with additives and industrially processed ingredients that have been technologically broken down and modified. Examples include sugar-sweetened beverages, confectionery, savoury snacks, refined baked goods, sweetened yoghurts, biscuits, and many varieties of fast food and ready-to-heat products.
- **Urban beekeeping**: The practice of keeping bee colonies in urban areas.

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