

# The evolution of science education

A report by Oxford University Press



**“Give students science capital, either to make informed decisions on health, environment, and technology or to see the value of following a career in science that could lead to making an impact on society.”**

Secondary science teacher, UK



## Contents

Foreword from Dave Leach, Global Assessment Director at OUP	02
Introduction	04
What should the core purpose of science education be?	06
How well does current science education prepare learners?	08
What are the biggest challenges that students might face in their future that science education should prepare them for?	14
What new skills and competencies do students need to develop to address these challenges?	16
What impact has the global Covid pandemic had on science education?	17

# Foreword

“When we were first appointed as the developer of the PISA 2025 science framework in late 2019 we could never have predicted the chaos that the pandemic would bring. With an extensive and global background in science pedagogy and publishing, we were very aware of the feelings of many science teachers about how their subject needed to grow, but this came into very sharp focus as the pandemic subsumed the world.

While we continue to develop the framework with the OECD and our expert group, we wanted to elevate the voices of teachers, to start a global conversation about how we enable learners to benefit from the lessons of the past 15 months, and how we equip them for the challenges that lie ahead of us. I want to thank my OUP colleagues and the PISA Science 2025 Strategic Visioning Expert Group for lending their expertise, some of whom we’ve been able to include within this report. I look forward to telling you more about the framework next year and continuing the discussions about the future of science education.”



Dave Leach, Global Assessment Director,  
Oxford University Press



*“I always enjoy hearing teachers’ views on the future of education and welcome this report. The scientific challenges of the past year with the pandemic and the ever-growing signs of climate change mean that there has never been a more important time to focus on science, empowering students to thrive in a changing world. I look forward to continuing this conversation about the future of science education, particularly when we release the new PISA 2025 science framework next year.”*

Andreas Schleicher, Director for Education and Skills, and Special Advisor on Education Policy to the Secretary-General at the Organisation for Economic Co-operation and Development (OECD)

**The Covid-19 pandemic has brought the role of science into sharp focus. Whether it's involved data literacy to interpret the statistics, or epidemiological modelling to anticipate what's coming next, we have all had to educate ourselves and come to terms with new realities.**



**398**  
teachers from  
22 countries  
responded to  
our questions

In 2019, Oxford University Press began developing the PISA 2025 science framework with the Organisation for Economic Co-operation and Development (OECD). Our goal? To understand what knowledge and skills children will need to have to further science and address the scientific challenges that face us in the coming 25 years.

As part of this process, we've been lucky enough to work with some leading experts in the field of science education, some of whom

we've featured in this report. We've also leant on the dynamic and close relationships that we have with teachers globally. They have told us how they feel about the state of science education, the ongoing impact of the pandemic, and the issues they think their practice will need to prepare children for in the future.

We felt compelled to share the voices of these teachers because what they said was striking: for many, science education is not fit for the future.

398 teachers from 22 countries and regions responded to our questions and we represent them here, alongside voices from leading experts in science education. The PISA 2025 science framework will be revealed in 2022; until then, we hope this research will provoke discussion and engagement to inform the way we teach young people science and equip them with the skills to address future challenges.

# What should the core purpose of science education be?



We began by asking teachers what they felt was the core purpose of science education. They responded by saying it was multi-faceted, and could broadly be summarized as the process of delivering against the following four criteria:

## 01

Inspire learners to engage with science.

First and foremost, respondents described the need to promote and instill an interest in science in order to fully engage learners.

## 03

Teach skills to enable effective experimentation.

Building on solid foundations in scientific concepts and theory, respondents then described needing to teach students the skills required to conduct practical science through experimentation.

## 02

Teach underpinning scientific concepts.

Having generated interest in science, participants described the need to teach core scientific concepts and principles which underpin success in science.

## 04

Help learners to achieve a range of desirable outcomes through science.

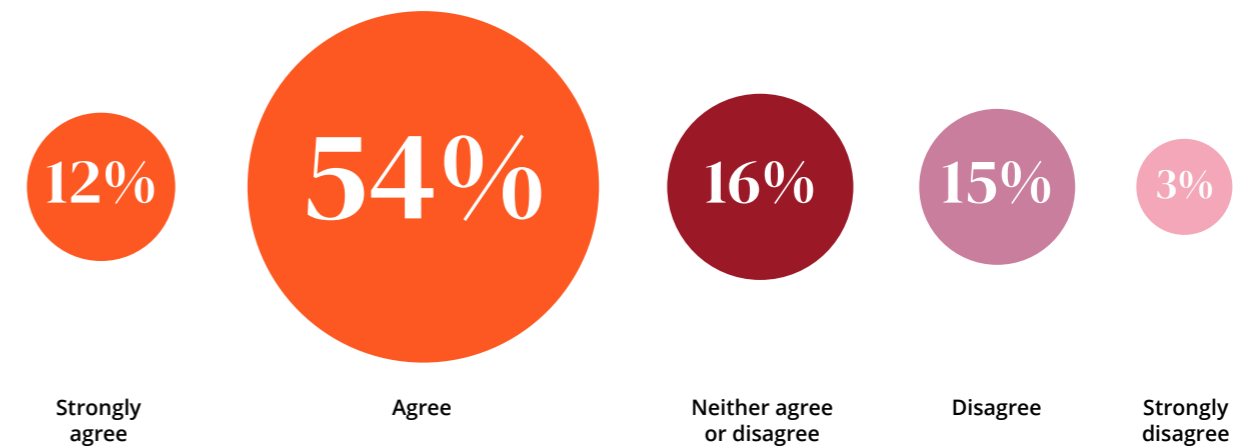
Having developed science skills, teachers hope that their learners will be better placed to succeed in a world permeated by science.

# How well does current science education prepare learners?



## 01

The science curriculum currently taught in our schools enables young people to become scientifically literate and active citizens

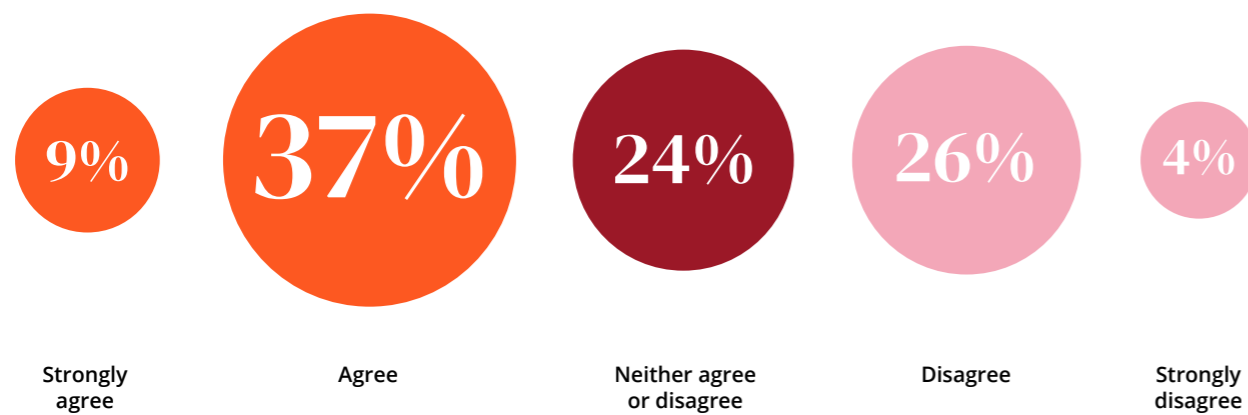


There was general agreement that current science education allows learners to become scientifically literate and active citizens (66% agreed vs 18% who disagreed) and that current science education provides students with the skills to interpret data to make evidence-based decisions in their everyday lives (68% agreed vs 20% who disagreed).

**66%**  
agree that learners become scientifically literate

# 02

## The science curriculum currently taught in our schools prepares young people to address the challenges that our world will face in the future



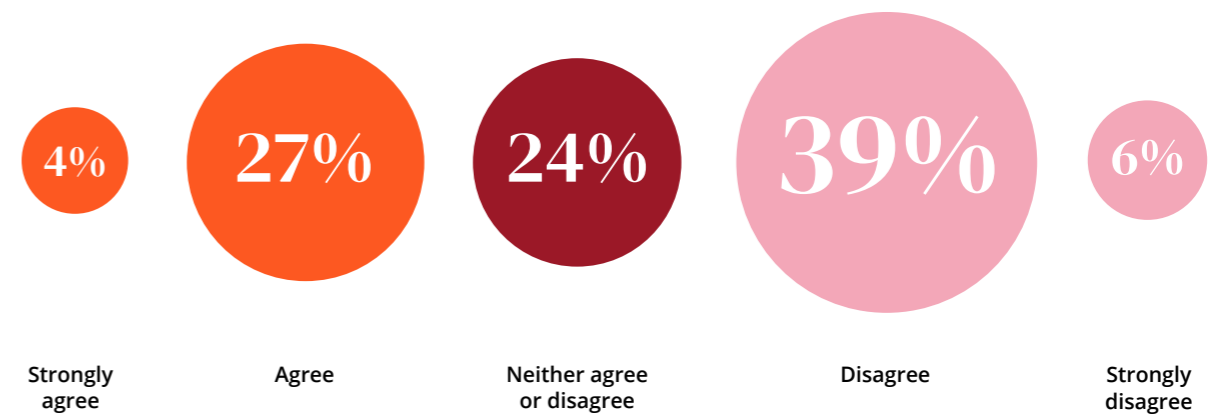
However, teachers are far more polarised in their views when asked whether the science curriculum currently taught in schools prepares young people to address the challenges that our world will face in the future. Fewer than half of teachers (46%) agreed with this statement and 30% disagreed with it. This would suggest that, faced with a rapidly changing world, a significant proportion of teachers feel the science curriculum taught in their school is failing to adapt and keep up.

Helen Silvester, twice shortlisted for the Prime Minister’s Secondary Science Prize for Excellence in Science Teaching in Secondary Schools, reflects on the introduction of STEAM to science teaching in Australia: *“The national introduction of STEAM (science, technology, engineering, the arts, and mathematics) has provided a new approach to science education... STEAM teachers model critical thinking, teach students to be creative (it can be taught) and let them fail so they can learn to try again... These are the skills that employers of the future will seek when the dirty, dangerous, and dull jobs are done by robots.”*

**46%**  
agreed that schools  
prepare young people  
for the future

# 03

## Current science education is fit for the future



Having established that fewer than half of teachers feel that science education prepares young people to address future challenges, we then asked them how fit for the future the subject is and how it needs to change.

Based on current practices, only a minority of teachers (31%) report that science education is fit for the future, while close to half of respondents (45%) disagreed with the statement, resulting in a negative net agreement score of -14%. This suggests that by and large, teachers do not feel that science education in its current state is fit for the future.

**31%**  
report that science  
education is fit for  
the future



With this in mind, teachers made a number of recommendations to governments, suggesting ways in which they should adjust their education policy in the sciences and STEM.

- The most widely cited recommendation is that science education should focus on instilling practical skills through experimentation in the classroom. This has been particularly challenging since the start of the Covid-19 pandemic.

*“Ensuring a strong understanding of the basis of scientific method – hypothesis, testing, conclusion. Encouraging the application of their knowledge to practical activities – not necessarily investigations but something that requires them to apply something they know rather than simply testing a proven theory.”*

Secondary physics teacher, UK

- Respondents recommended reviewing the existing curriculum being used, ensuring that the content is up-to-date and reflects the world that learners live in as well as preparing them for the future. Teachers also recommended reducing the amount of content to allow for more depth of learning.
- As a third recommendation, teachers wanted greater connection between the science that is being taught in the classroom and what is happening in the world outside. Current teaching can be too theoretical, which does not help learners to understand the role that science plays in everyday life.

*“Science is everything but students feel disconnected. Make the science curriculum personal. Create excitement and wonder about how science is truly exciting.”*

Secondary physics teacher, UK

- There were also calls to re-examine the exam system. At present, teachers told us that assessment is too knowledge focused, and respondents want exams to place more focus on assessing application. Some reported that linear exams were not helpful in this regard as coursework allows assessment to take place through practical experimentation. In general, respondents also felt there was too much emphasis on exams.

**“Make the content of the courses more up-to-date and relevant to the modern world...”**

Secondary science teacher, UK





# What are the biggest challenges that students might face in their future that science education should prepare them for?



As the world continues to address the global Covid pandemic and the many scientific challenges that brings, teachers were relatively united when it came to identifying the biggest challenges that students might face in their future.

Around a quarter of all respondents cited climate change, reflecting the pervasiveness of the issue throughout the tumult of the past year or so and the relevance of their subject to addressing the threat to the natural environment.

Interestingly, fake news was the second most widely cited challenge that students are likely to face in their future. This issue is gaining extra attention in response to the Covid pandemic. Respondents felt that it has never been easier for individuals to spread fake news, and never harder to distinguish what is scientific fact from what is fake. Critical thinking is a key skill for learners in this environment.

The pace of change, both in terms of technological advancement as well as more general societal change, was also felt to be a significant challenge that students will have to face. Technology was a common thread throughout the responses to this question, citing data analysis, the fourth industrial revolution, AI, and technology in the workforce as future challenges.

Bonnie Schmidt, President and Founder, Let's Talk Science, comments: *"Science education for the future must evolve (or transform), to focus more on building the abilities and desire of all youth to contribute in meaningful ways through work and citizenship opportunities in our fragile world."*

**25%**  
cited climate change  
as the biggest challenge  
in the future of  
science education

## What new skills and competencies do students need to develop to address these challenges?

- In order to prepare learners to overcome these challenges, teachers cited the need for a range of higher order cognitive skills, including critical thinking, problem solving skills, creativity, and mental flexibility.
- Teachers described how these higher order cognitive skills need to be supported with solid foundations in science, specifically the ability to conduct robust experimentation using the scientific method, supported by good scientific literacy, the ability to process and understand data, and a good understanding of maths.
- A range of interpersonal skills were also mentioned, including communication and collaboration skills, creativity, personal drive / initiative, resilience, and the ability to persevere.



The inclusion of interpersonal skills and creativity alongside a solid foundation in science and higher cognitive skills is important to highlight here; it reflects a recognition of the need to be able to communicate scientific findings and relate them to the wider population, an issue that has been played out throughout the Covid pandemic.

## What impact has the global Covid pandemic had on science education?

Given the impact of the pandemic on education globally, we felt it was important to ask what impact it had had on science teaching. In general, teachers reported that the focus of science education has not changed as a result of the Covid-pandemic (fewer than half of teachers agreed, 42%). However, the broader findings of this survey suggest that the pandemic has prompted some re-evaluation of current science curricula and the need for change in future.

Bonnie Schmidt from Let's Talk Science continued: *"Our world is changing much faster than science education. Furthermore, during the global Covid-19 pandemic... public trust in science was crucial for containing the spread of the virus and driving vaccine adoption. Around the world, for the very first time,*

*everyone experienced science 'in real time' and it became clear that many did not understand the nature and processes of scientific inquiry."*

Unsurprisingly, there was much stronger agreement that the way science is taught has changed as a result of Covid-19. Two thirds (67%) of teachers reported this, citing fundamental changes, namely a move to online teaching, and fewer opportunities to conduct practicals and experiments. While the move away from the classroom is short-term, it is important to consider the longer-term impact on those learners. Many governments are prioritizing the need for young people to catch up on lost learning due to lockdowns; given the vital role that science education plays in preparing learners to address future challenges, this gap in learning clearly requires additional focus.

### 42%

agree the pandemic hasn't changed the focus of science education

### 67%

agree the way science is taught has changed as a result of Covid-19

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