Limit Less

Teaching without limits

The need for a whole school equity approach

IOP Institute of Physics

Secondary schools in England

Information about the surveys referred to in this document

In 2020, the IOP commissioned Censuswide, an international market research consultancy, to conduct two surveys and a series of focus groups to inform our campaign. The survey was of 3,007 parents and carers of children aged 5–16 in state schools in the UK and Ireland. In 2021, we commissioned Censuswide to conduct a further survey of 2,000 primary and secondary school teachers across the UK and Ireland.

Information about the quotations used in this report

In the preparation of this report, the IOP asked its members to provide their own stories of lived experience related to the stereotypes and barriers that our campaign aims to dismantle. A similar request was made to subscribers to IOP's Qubit newsletter, who are aged 16–19. A series of requests was also posted on IOP's Twitter account, @physicsnews. The IOP is grateful to everyone who has shared their experiences with us and invites anyone reading this report who would like to share their own experiences to please contact us at campaigns@iop.org.

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What is Limit Less? And what are we asking you to do?

To ensure that all young people have the same opportunities, there needs to be a transformation in our schools.

The Institute of Physics (IOP) knows that many young people are put off studying physics after the age of 16, not because of a lack of ability or interest in the subject, but because of prevailing social attitudes that discourage them. There is a widespread misconception that physics is a subject for other people, perhaps people who they think are cleverer, or who come from more privileged backgrounds or particular social and ethnic groups. This leads to many young people deciding that 'physics is not for them'. This view is picked up from all around – be it the education system, from parents and family, and from among local communities and wider society.

This must change. Limit Less is the campaign that aims to encourage and support young people to change the world and fulfil their potential by doing physics. It seeks to challenge the misconceptions and stereotypes about the subject and remove the barriers to young people doing physics beyond the age of 16.

And we need the help of teachers and senior leaders in our schools and colleges to call for this change in our system.

Schools and teachers are important influencers of young people and their parents, and we know that your work is crucial to encourage more young people from underrepresented groups to study physics in school and consider a career using physics. We need your voice to help us challenge the government to make this Limit Less dream a reality.

We are asking that you sign up to support the IOP's manifesto for change which you can read in this report. It outlines how schools and nurseries can be more inclusive across the UK and Ireland. There are ten areas of improvement that can help make physics learning, and all education settings, more inclusive.

We look forward to working together to build a fairer and more inclusive environment in schools for all young people through the Limit Less campaign.

Which young people are we talking about?

The IOP has identified five groups that are currently underrepresented or underserved in the physics community – young people in these groups are less likely to do physics and more likely to face a hostile environment when they do. These groups are:

— Girls

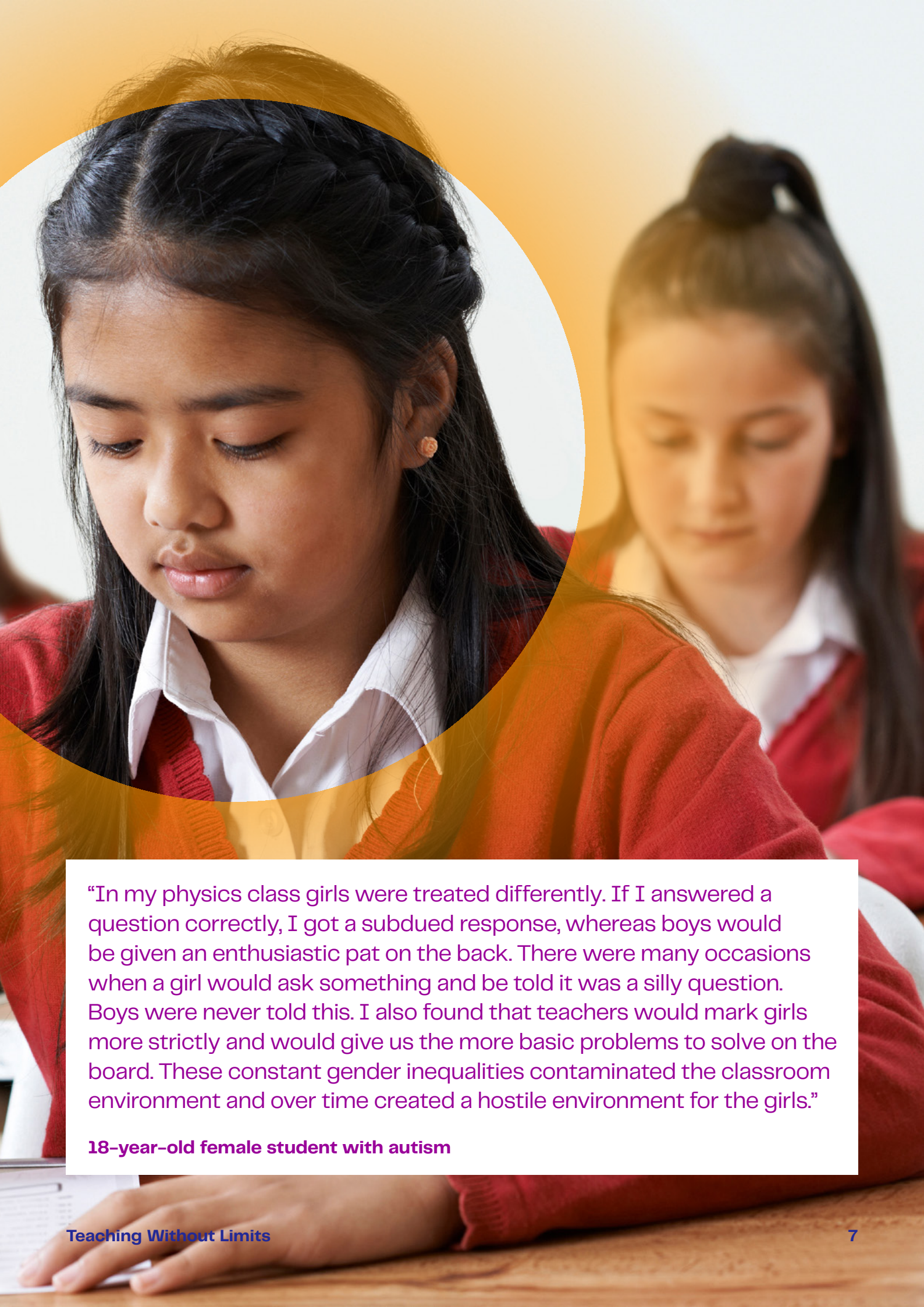
— Young people from disadvantaged backgrounds

— Disabled young people

— LGBT+ young people

— Young people of Black Caribbean descent

This report explores the issues in encouraging young people from these groups to continue with the subject, as well as discussing some of the solutions. It also provides an overview of the available data relating to participation and attainment in physics beyond the age of 16, as well as the significant data gaps for certain groups.



"In my physics class girls were treated differently. If I answered a question correctly, I got a subdued response, whereas boys would be given an enthusiastic pat on the back. There were many occasions when a girl would ask something and be told it was a silly question. Boys were never told this. I also found that teachers would mark girls more strictly and would give us the more basic problems to solve on the board. These constant gender inequalities contaminated the classroom environment and over time created a hostile environment for the girls."

18-year-old female student with autism

The facts

Ethnicity

Students of Black Caribbean descent have the lowest progression rate to A level physics in the 2019 reported data for English state schools.

2.0% of students of Black Caribbean descent progressed to A level physics in 2019

compared to 5.1% of the rest of the cohort.

(Source: Improving Gender Balance and Drayson Foundation Pilot Project Evaluation Report, https://tinyurl.com/IOPdata2020)

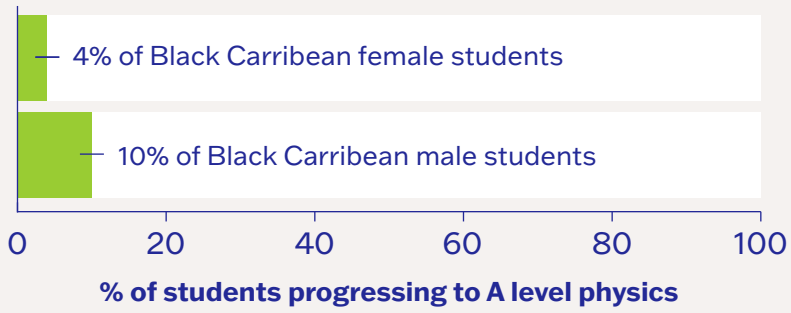
Gender

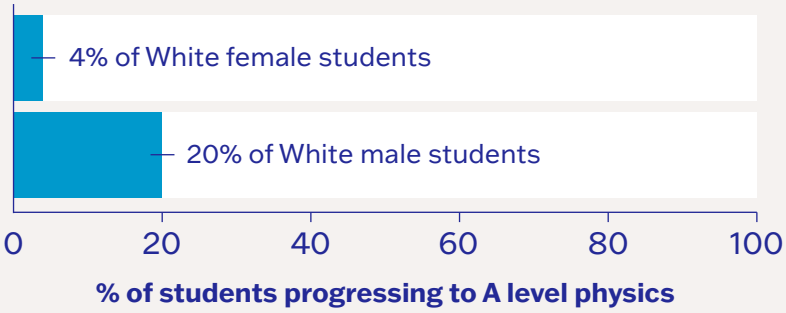
In 2021, there was an increase in the number of female students taking physics A level but they were still only 23% of the cohort.

(JCQ, 2021)

For students of Black Caribbean descent, the proportion of female students who progressed to A level physics was 4% compared to 10% for their male peers. For White British students, 4% of female students progressed compared to 20% for their male counterparts.[1]

For all ethnic groups, the number of female students choosing physics is significantly less than the number of male students.



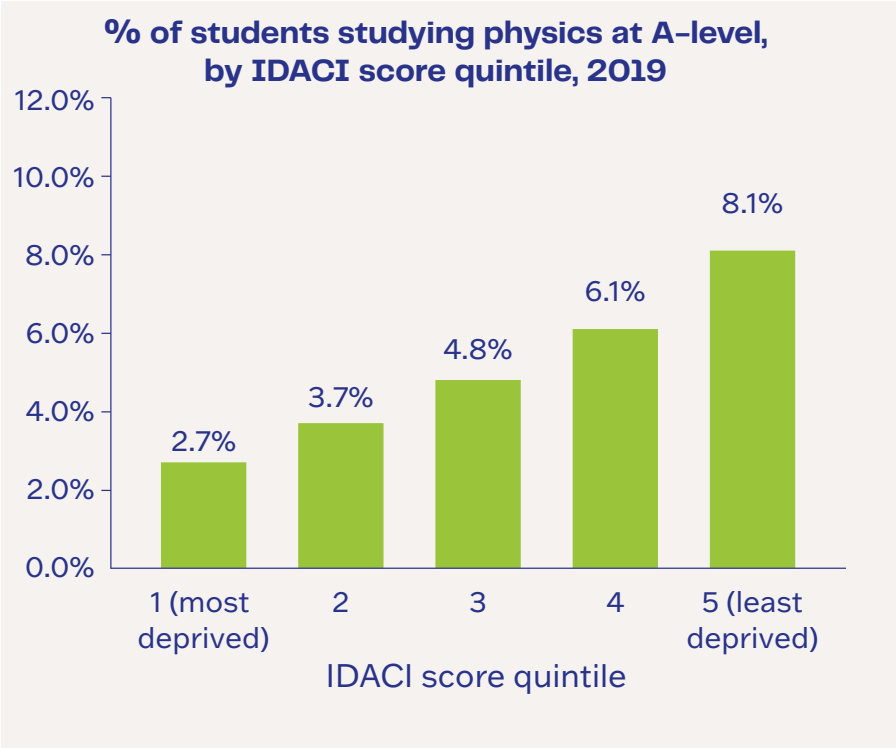


1 Using 2019 data for non-free school meals (FSM) students, as published by STEM learning

Disadvantage

Limited by social background

Using the Income Deprivation Affecting Children Index as an indicator of socio-economic background, there are stark differences between young people from families on low incomes compared to those from the least financially deprived families.



All state schools in England, 2019. Source: Improving Gender Balance and Drayson Foundation Pilot Project Evaluation Report.

Female students of Black Caribbean descent eligible for free school meals are **three times less** likely to progress to A level physics than *male* students of Black Caribbean descent eligible for free school meals. Those not registered for free school meals are **2.5** times less likely to progress to A level physics than corresponding male students.

Female White British students eligible for free school meals are **seven times less** likely to progress to A level physics than *male* White British students eligible for free school meals. The difference is even starker when we combine factors. If you are a *female* White British student eligible for free school meals then you are **10 times less** likely to progress to A level physics than a *male* White British student NOT eligible for free school meals.

Disability

The DfE collects data on pupils with special educational needs (SEN) which includes learning difficulties, physical impairments and social, mental and emotional health. These students have learning difficulties or disabilities that make it harder for them to learn than most children of the same age.

Across all subjects in 2020, 14.7% of pupils taking GSCEs had a known special educational need. This drops to just 5.1% for students taking exams at age 18.

For those who choose physics A level, only 4% have known SEN.

Disabled girls compared to boys

When we include gender as factor then progression to A level is reduced further.

Of those choosing physics A level:

— And receiving SEN support, only 18.8% were girls

— With an education, health and careplan and receiving SEN support, only 5.3% were girls

How many young people from the underrepresented groups study physics in your school? How could this be improved?

A word about data

When preparing this report, we wanted to present as complete a picture of the situation in England as possible, with data related to each of the underrepresented groups. Unfortunately, not all of the relevant data is either collected or publicly available. The IOP believes that more needs to be done by those responsible for young people's education to collect and publish data related to young people and the study of physics.

Why is there an issue?

For many years, the IOP has recognised the inequity in physics which has long existed in education, academia and the workforce.

Since the publication of "Girls in the Physics Classroom" in 2006, the IOP's understanding of the causes of imbalances, and the strategies to help overcome them, have developed considerably. However, despite efforts by the IOP and others to address this problem, the proportion of underrepresented students studying A Level physics has stayed roughly the same over many years. This is despite the total number of students taking physics A Level in 2021 being the highest since 1992.

Significant barriers remain for participation in physics throughout educational levels and these are more pronounced for underrepresented groups, leading to a vicious cycle of underrepresentation. There is also evidence to suggest that this is leading to higher-attaining students in underrepresented groups, declining to participate in physics beyond GCSE.[2]

2 IOP: Why not Physics: a snapshot of girls' uptake at A-Level (2018) why-not-physics.pdf (iop.org)

The personal experiences that have been shared with the IOP by our members and other physicists highlight some of the challenges young people face within the education sector when hoping to progress to post-16 physics, such as:

"I quickly realised that I didn't know anyone working in a STEM field except my GP or my dentist. I didn't know anyone who looked like me, I couldn't name more than two people who weren't white."

20-year-old female physics student of Asian descent, England

"Despite consistently getting A*s in my physics GCSE work... I thought I wasn't good enough to do A-level and didn't have much in common with the type of boys who seemed like they liked it so much more than me."

19-year-old female physics student of Gypsy or Irish Traveller descent, England

"Sometimes I feel alienated by members of the class. Many of them also use homophobic language when talking to other students, which is uncomfortable for the few LGBT members of the class, including me."

17-year-old LGBT+ female physics student, England

Our manifesto for change

The IOP is calling on the governments of the UK and Ireland to:

1. Revise professional standards for teachers to set out an expectation that teachers will address injustice in their professional practice and actively dismantle any sexism, racism, homophobia, ableism and classism from their own work and their schools.
2. Ensure that all teachers are trained to teach inclusively and to tackle injustice so that they can achieve these robust standards. This should be in both their initial teacher education and their continuing professional learning and development.
3. Direct those responsible for school inspections to place greater emphasis on the importance of inclusive teaching and schools' efforts to address injustice.
4. Mandate nurseries and schools to develop whole-school equity action plans that:
   - are informed by ongoing data and evidence collection including students' choices.
   - promote equity and equality for young people in underserved groups.

In all nurseries and schools, the IOP wants to see:

5. All staff challenge bias and stereotyping.
6. Educators, parents and students develop and implement whole-school equity action plans that provide an inclusive environment and promote equity and equality for young people in underserved groups.
7. Those responsible for school governance play an active role in ensuring that equity and equality are promoted in their schools and that inequalities are addressed, including appointing a member with specific responsibility for equality.
8. Teachers teach physics and science in an inclusive way that promotes a positive, contemporary view of physics and portrays physicists from a wide range of backgrounds including the underrepresented and underserved groups.
9. All young people and their parents and carers receive a high standard of careers advice that includes physics-related career options and promotes studying physics beyond age 16.
10. More young people from underserved groups benefit from learning outside the classroom, such as in science or STEM clubs.

A whole school approach to equity

Research by the IOP has indicated that school culture is a substantial factor in determining subject choice. One study, "Closing Doors", showed that 81% of state-funded, mixed schools were either maintaining or exacerbating the already poor gender imbalance of progression into English, mathematics, biology, physics, economics and psychology. The study also showed that to reduce the gender imbalance in one subject, the schools needed to look to reduce the imbalance in other subjects, underscoring the importance of a whole school approach. The conclusion of the data analysis was that gender imbalances arose from school culture, biases, and gendered expectations of students.

A subsequent study, "Opening Doors", looked at good practice in schools for countering such stereotyping. This research emphasised that to truly challenge biases and stereotyping, work must go beyond the physics classroom. For systemic and sustainable change, commitment is needed from students, teachers of physics and of other subjects, senior leaders, governors, trustees, parents and carers. When such approaches have been used, the impact has been significant. For example, the number of girls taking AS-level physics more than trebled in over two years following a whole-school challenge to address imbalances.

"A whole school equity plan is ensuring that the school (our community – so that's the parents, the students, and the teachers) are all involved in coming up with a common vision: that every child in the community is entitled to that inclusivity and diversity of the curriculum that allows them to see beyond, not only what they have right now in front of them in terms of their own community but the wider picture, and they can then build upon when they go into society."

Jamie Drake, Curriculum Director of Science and Social Science, Noel Baker Academy, Derby

Learn more at: iop.org/WholeSchool

86% of secondary school teachers who have whole school equity plans reported seeing positive change as a result of the plans being implemented.

Censuswide survey of 2000 primary and secondary school teachers across the UK and Ireland

A whole-school approach truly involves the whole school. Areas to consider are shown below:

Personal practice: supporting staff to reflect	All teaching and non-teaching staff within the school should be included in such work, trained to play an active role and made aware of the effect of biases, conscious and unconscious
Student voice: putting young people at the heart of change	A crucial step is supporting children and young people in understanding and challenging injustice and stereotypes and allowing them ownership of the issues
Curriculum and learning	Resources and the curriculum should be audited to ensure equal opportunities. Students should be able to choose subjects and activities based on their preferences and skills, rather than being guided by their gender, race, sexual orientation, disability or background
Progression, choices and jobs	Everyone has a role to play in opening students' eyes to the diversity and range of options available for their future, which should not be limited by their own or others' expectations
Internal and external communications	Schools communicate with a wider variety of audience including parents, carers, students, staff and the wider community. Processes should be put in place to make sure communication and materials counter stereotypes and do not reinforce bias
Engagement with parents, carers and the wider school community	The biggest impact will be made when the whole school community works together. Involving parents and carers from the start can help children and young people challenge inequality in wider life

The English perspective

What do the teaching standards have to say about equity?

Whilst the previous **Professional Standards for Qualified Teacher Status and Core Standards** mentioned equality and diversity, the new Teachers' Standards no longer explicitly address these issues.

Neither 'diversity', 'inclusion' or 'equity' are mentioned specifically in the standards, although teachers "must have an understanding of, and always act within, the statutory frameworks" which includes the Equality Act 2010.

Sex, ethnic group, sexual orientation, gender identity, class or socioeconomic background are not mentioned, but young people with special educational needs, and those with disabilities are specifically mentioned under Standard 5 – "Adapt teaching to respond to the strengths and needs of all pupils", emphasising the need "*to use and evaluate distinctive teaching approaches to engage and support them*".

What do Ofsted have to say about equity?

Ofsted has identified concerns over the narrowing of the curriculum – "this means that too many learners, often the most disadvantaged and those with special educational needs and/or disabilities (SEND), are not given access to a broad, rich and deep curriculum. This can result in unlawful discrimination, contrary to the Equality Act 2010. These issues relating to the narrowing of the curriculum are affecting all learners, including those across the spectrum of protected characteristics."

Ofsted is also putting increased emphasis on reducing discrimination in schools:

"The framework is clear that to be graded as good or better for behaviour and attitudes, a provider needs to create an environment where bullying and discrimination are not tolerated and, if they do occur, they are rapidly and effectively dealt with so as to prevent it spreading."

71.4%

of secondary school teachers in the UK and Ireland agreed that societal issues, such as equity and inclusion, have a place in subject specific teaching.

Censuswide survey of 2000 primary and secondary school teachers across the UK and Ireland

What you can do

To build a fairer and more inclusive environment in schools for young people from underrepresented and underserved groups we need your support. Today you can take the following actions:

1. Sign up to the manifesto

Please sign up to the manifesto today so that we can show our politicians that we have widespread support for improving equity and inclusion across the education sector. To sign up on behalf of your school or as an individual teacher, or both, please visit https://campaign.iop.org/manifesto.

With your help we will call on the government in England to provide more support for teachers to create inclusive school environments. We will take our message to MPs, parliamentary groups and officials to get their support in both parliament and in the media and push for concrete changes.

2. Learn more about the Limit Less campaign and share!

Visit the main Limit Less campaign page iop.org/LimitLess to find out more about the campaign, view resources, and read stories from people who were deterred from physics because of who they are.

We have a growing number of individual supporters and would welcome even more. Please share this link with your friends and family and ask them to join as individual supporters, the more people who join our campaign, the more likely we are to change young people's future for the better.

3. Tell us about your whole school approach

If your school has already adopted a whole school approach and is building an inclusive environment for all students, we would be very interested to hear from you, both to celebrate your success and so that others can learn from your activities. Please contact us at campaigns@iop.org.

"I had a very positive physics teacher who encouraged me to go to lots of different events and events he organised. I wouldn't have researched my options without his input or believed it was something I could pursue. Before that there was very little information about the subject at primary school and we were never told about science careers. My family have also been very supportive whilst encouraging me to explore my options."

17-year-old white female physics student from England